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The Institute of British Foundrymen
The Institute of Vitreous Enamellers
The Welsh Engineers' and Founders' Association
The Foundry Trades' Equipment and Supplies Association

Institute of British Foundrymen

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The Potentialities of Vitreous Enamelling

In dealing with this subject we do not propose to address ourselves to foundries other than those currently manufacturing castings destined to be enamelled, and we do so with the object of taking their minds away from current productions to those associated with peacetime activities. The first thing that a jobbing founder must learn is that not all shapes and sizes of iron castings can be successfully enamelled; moreover, he is well aware that co-operation with the designer and patternmaker is axiomatic for the successful and economic production of ordinary grey iron, and to these executives he must add the vitreous enameller if success is to be assured. Moreover, he must learn to keep the raw castings clean and dry before and during despatch to the enamelling works or department.

The composition of the iron used is not so very important, and all grades have at various times been successfully processed. There are potential outlets for enamelled castings because of two main factors, the first and most important is the selling appeal of coloured material of unquestionably durable quality; the second is the corrosion resisting properties associated with this finish. In marine engineering there are a number of fittings liable to contact with salt water and spray which constantly require painting, and particularly difficult is the reading of the name plates on the auxiliary engines on the decks of oldish vessels. A well designed screwed-on name plate carrying date of manufacture, and of the same composition of the main casting (so as to limit corrosion by reducing electrolytic action) is a good lasting advertisement. The tips of propellers could be usefully the subject of experiment. In motor vehicle manufacture, enamelling can often advantageously replace chromium and nickel-plated fittings, whilst an anti-corrosive application is the internal enamelling of the exhaust pipes. In railway engineering much the same conditions appear, and the brass carriage handles and fittings would look better and save much labour if vitreous enamelled. Foundries making garden and public park furniture should carefully examine the potentialities of vitreous enamelling. Quite often the municipalities call for their coat of arms to be included as a decoration on various benches and gates. A foundry submitting specimens in colour would have a much better chance of receiving the contract than those showing either plain or painted ones. The castings "please keep off the grass" and the small ones giving the names of the various trees and plants are fairly obvious suitable applications for vitreous enamelled goods.

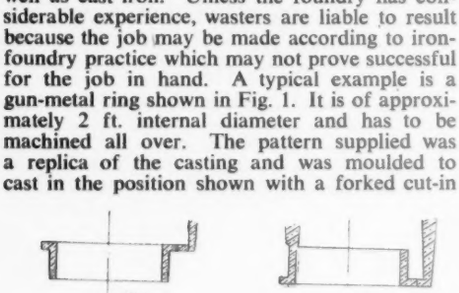
A fairly large field should also exist in the agricultural and dairy engineering businesses. Farmers, because of the rates he has to pay on farm buildings, prefers to leave most of his implements in the open air, and the lasting qualities of vitreous enamel would in this case be extremely helpful to him, besides offering an initially greater sales appeal. The fractional horse-power motors, destined for use in either the home or in clean environments, would make a better appeal if carrying an easily cleanable surface such as is presented by vitreous enamel. Fuse boxes, which have in recent years suffered a good deal of competition from plastics, would probably regain and maintain this important market. The idea could possibly be extended to some of the switchgear for power stations, as the control rooms, year by year, more and more take on the aspect of a cinema star's bath room.

For municipal castings, the worth of the coating has been well proved by the enamelled cast-iron road tiles, which as far as we could see never chipped. By so treating gulley grates and manhole covers they could be removed from what has often been a ridiculously cut price market. It might be a little daring to suggest the enamelling of lamp standards, because of their length, but once successfully marketed, the painted variety would quickly become obsolete, in much the same way as the unenamelled gas cooker. If it be decided to replace some of the railings, removed for war salvage, then these too could be usefully carried out in vitreous enamel so as to eliminate the biennial cost of repainting. The lawn mower, the handles of the cast-iron garden shears, the roller, door furniture, picture hooks, plumbers' fixtures, book rests, pneumatic and electric tool sets for garages, are but just a few of the jobs worth while reviewing from the angle of bestowing a better appearance of a lasting character.

Some Jobbing Foundry Experiences—XXIV

By "TRAMP"

Jobbing foundries are occasionally called upon to make castings in the non-ferrous metals as well as cast iron. Unless the foundry has considerable experience, wasters are liable to result because the job may be made according to iron-foundry practice which may not prove successful for the job in hand. A typical example is a gun-metal ring shown in Fig. 1. It is of approximately 2 ft. internal diameter and has to be machined all over. The pattern supplied was a replica of the casting and was moulded to cast in the position shown with a forked cut-in



runner made on the joint as indicated in the plan view Fig. 1, and a small riser opposite. As may have been expected by those with non-ferrous experience this casting was a waster because of shrinkage and contraction cracks around the runner. The replace casting was made to cast the large face down and a single cut-in runner used from a large heavy downgate which was placed as near the pattern as possible. This obviated the contraction cracks and the large heavy runner served as a feeder to this portion of the casting while a large heavy rectangular riser served the same purpose on the rim opposite, as is shown in Fig. 2.

Medal Awards Presented at the A.F.A. Annual Convention

At the Annual Convention of the American Foundrymen's Association, the four major gold medal awards of the Association for meritorious service were made to four men who have made outstanding contributions to the advancement of the foundry industry. The awards are:—

The Joseph S. Seaman medal to Mr. Charles Edgar Hoyt, executive vice-president and manager of exhibits of the American Foundrymen's Association. The award to Mr. Hoyt is being made for his exceptionally outstanding service to the foundry industry as manager of the foundry exhibits since 1908, as secretary and treasurer of the Association from 1918 through 1936, and as executive vice-president since 1936.

The J. H. Whiting medal to Mr. Donald J. Reese, engineer, Research and Development Division, International Nickel Company, New York City, for his outstanding contributions to the foundry industry and the Association through his work in the improvement of cupola melting methods.

The W. H. McFadden medal to Mr. Max Kuniansky, general manager, Lynchburg Foundry Company, Lynchburg, Va., for outstanding contributions to the grey iron industry and the Association.

The John A. Penton medal to Mr. Fred L. Wolf, technical director, Ohio Brass Company, Mansfield, O., for his outstanding contributions to the non-ferrous and malleable castings industry and the Association.

The four major awards of the Association are gold medals provided for by funds donated in 1920 by four pioneer officers of the Association, each medal being named for one of the donors. In addition to the medal awards, the Association is recognising the long-continued service and early pioneering work in the technical development of the industry as carried on by Mr. Henry M. Lane, Grosse Isle, Mich., by making Mr. Lane an honorary life member.

I.N.C. to Carry On

The result of the postal ballot received from the members of the Ironfounders' National Confederation showed that only 65.5 per cent. of the members voted and as the Constitution requires 75 per cent., the resolution for dissolving the Confederation has failed. Curiously enough, 63 per cent. of those voting were in favour of the resolution. The covering letter announcing the result well states the position in the following terms:—

"The future of the industry as an organised body may depend on the statesmanship of the Council members at their next meeting and on their ability and foresight to see the industry as a whole and not as a loose body of disjointed parts.

"There are outstanding problems that are common to all ironfounders which must be dealt with and solved, at this time, when the country demands co-operation in industry. These days are difficult enough but, in the future, ironfounders may discover the need of associated effort to adjust the disparities created by war conditions and to ameliorate the hardships that invariably accompany the aftermath of war.

"For the immediate present, individuals and sections must sink their differences in the existing crisis, and, for the future, strive to achieve peace in industry as well as in national affairs. An effective central organisation for the ironfounding industry must therefore be evolved forthwith."

Correspondence

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

To the Editor of THE FOUNDRY TRADE JOURNAL.

Melting Borings

SIR,—I was very pleased to note the letter by Mr. Slingsby in your issue of May 22, 1941, stating that he puts on a charge of loose borings at the end of each cast in the cupola. It may be of interest to state that I worked out a process for melting loose cast-iron borings and have done so regularly for the past four years.

The process was put before the B.C.I.R.A. Committee in detail and a patent was obtained by the B.C.I.R.A. However, mainly due to excessive caution, the process has not been taken up, to my knowledge. When the war started it was announced that all royalty rights would be waived in order to hasten its adoption in the national interest, but I still do not know of any firm availing themselves of the B.C.I.R.A. services in starting up, with the possible exception of a large South African concern.

The process, which is essentially the same as that referred to by Mr. Slingsby, runs continuously for a normal cupola melt of, say, three hours, or longer if desired, handles up to 100 tons per month and used in conjunction with a casting machine, as already described, absorbs a further 30 tons of steel turnings.

Mr. Slingsby is to be congratulated on his individual effort which I am sure he will find profitable and more so if he carries it a stage further.—Yours, etc.,

WM. Y. BUCHANAN.

May 27, 1941.

Random Shots

It will come as a pleasant relief to those compelled to take many meals in hotels that the proposed sugar restriction is to be repealed. Tea and coffee, those beverages so welcome when one has risen surly, are not nearly so delectable when sweetened with saccharin, and sound even less so when sweetened with benzoic sulphamide, which is its official name!

* * *

It is stated that in order to produce "The New York Times" fifty square miles of timberland are felled every year. Few people in the foundry industry, too, realise that it takes ten tons of paper to produce the Annual Proceedings of the Institute.

* * *

Amongst the theories put forward over the air to explain the presence of the "Bismarck" in Northern waters is that it was a red herring to put the vigilant eyes of the Royal Navy on the wrong trail. Surely the speaker meant a Bismarck herring?

* * *

"Eminent works' managers have on more than one occasion confessed to us that they found it much easier to control a thousand men than ten women," states last week's leading article. Most men, of course, have only one woman to control, but even so still find it easier to manage a thousand men.

* * *

A very experienced aeroplane pilot was being shown how to fly a seaplane. After watching the instructor take off, fly around for a few moments, then bring the seaplane safely down on water, he decided to try for himself. All went well until he started manœuvring to bring the machine down on dry land.

"Hi, that won't do," called out the instructor, "take her out over the water; you're not in your Spitfire now, you know." The pilot, quickly realising his mistake, proceeded to climb again and to make a graceful descent on the water. One disaster certainly was avoided by his skill, but habit proved too strong in the end; for, whilst still chatting to the instructor, he got up and stepped out backwards, straight into the water! The dinghy, for the arrival of which he ought to have awaited, was still some thirty yards away.

* * *

An old timer, it is said, is a man who, whilst remembering when he could buy half-a-dozen eggs for sixpence, forgets that he had to work an hour in order to earn that amount of money.

* * *

There is not much variety in a woman's life, it has often been said. Even in these days of emancipation she either goes out with the johnnies firewatching, or else she stays watching the fire at home with the willies.

* * *

Definition up to date

A shiftless young person is one who spends all her coupons on outside show.

* * *

This week's crossword clue is chosen for its foundry flavour, and comes from "The Daily Telegraph":—

Clue: Not of good quality not even in cast.

Answer: Shoddy.

"MARKSMAN."

Catalogue Received

Insulation Tape. Details of a new type of insulation tape—the "Pernax" brand—are given in a leaflet just issued by British Insulated Cables, Limited, Prescot, Lancashire. It is designed for use out of doors and in wet and corrosive situations. In some cases application is improved by the use of a special Pernax tool which when warmed aids the adhesion of the tape.

Quality of Foundry Refractories Criticised

EAST MIDLANDS DISCUSSION

The East Midlands Branch of the Institute of British Foundrymen held their January meeting at the Jacobean Café, The Wardwick, Derby, the chair being taken by Mr. Bunting in the absence of Mr. S. E. Dawson, President of the Branch, through illness. A Paper entitled "Miscellaneous Developments in Foundry Refractories," presented by MR. OAKES, of Sheffield, was given as a prelude to a general discussion on the subject covered.

The lecture commenced with McWilliam and Longmuir's definition of the ideal refractory material; the altered requirements were then dealt with, the new conditions being brought about by the more exacting demands of the various industries for castings to meet the altered conditions of service, also the necessity of standardisation in the production of like war material and the most difficult problem of the substitution of home and Empire products to replace the continental.

After chemical analyses in relation to physical properties had been outlined, refractory materials for the various processes and furnaces were described and illustrated by drawings and samples of the materials, including the cupola process, steel converters, and electric furnaces of the arc and high frequency types.

Jointing materials were an important section both for acid and basic refractories, and important progress had been made in developing suitable cements, better able to withstand the severe working conditions. Foundry sands for the iron, steel and non-ferrous section of the industry were mentioned with particular reference to the increasing use of synthetic sands.

Lack of Specifications

MR. BUNTING, in opening the discussion, said the Paper had given a wide range for discussion but was unequal in its interest as the majority of the members were not producing steel castings. There were but few steelfoundries in the area. The lecturer had pointed to the difficulty of the refractories manufacturer to meet the requirements of the foundry industry.

This problem had previously been raised and the refractory manufacturers had complained they had no definite specifications or standards as a basis. They were also disconcerted as every foundry was now more insistent on its own particular requirements than in the past. Through research during and since the last war, much more interest had been taken in the use of refractories.

The Institute had carried out a considerable number of investigations and during the last war the Government stepped in to help the foundry by carrying out a national survey of the moulding sand resources. Finally, he asked whether there was anything better than firebricks for lining the cupola, as a serious improvement in the quality was desirable.

Basic Conditions Chaotic

MR. OAKES, in reply, said that the chief difficulty the refractory manufacturers had in working to a specification or standard material for cupola linings was the fact that the range of metal to be melted had a profound influence on the life of the lining. For instance, grey iron and hematite gave but little trouble, but the use of 90 per cent. steel scrap charges in cupola working in connection with the baby Bessemer was an entirely different problem.

Definite steps had been taken to improve the shape, texture and the burning of the bricks, especially the Scottish type, for cupola use. The 9-in. lining is the most generally used, either a double lining or the straight single cupola standard brick. Blocks were not so good, as they were difficult to burn even through the heart owing to the size. Regarding the jointing material one proprietary brand had given much better results than was the case with the ordinary ground fireclay generally used.

Decline in Quality Noted

MR. SANDERS commented on cupola refractories, because that was of interest to the majority of members present. He maintained that ganister was the most important cupola refractory, for generally speaking the furnaces were lined with aluminous firebrick and patched with siliceous ganister. Ganister was the Cinderella of refractories, as the manufacturers paid but little attention to improving it.

Bearing in mind the rapid heating and the still more rapid cooling of a cupola lining when the bottom was dropped and the drop watered down, would the lecturer recommend the best linings, as a hard brick was wanted in the shaft to withstand abrasion and a highly refractory lining able to be rapidly heated and cooled in the fusion zone? He also asked for details of the methods of testing refractories in the laboratory because the only tests available appeared to be the behaviour of the material in use.

Replying to Mr. Sanders, MR. OAKES agreed that hard burned brick was required in the shaft, but the brickwork should be set with a special cement in place of the usual fireclay joints, well-shaped bricks with a dipped joint gave the most satisfactory life. Thus a first-class high alumina brick was recommended for use in the high temperature melting zone.

As to the testing of refractories in the laboratory reliable tests were now in everyday use for ascertaining the chemical analysis; refractoriness, liability to spalling, slag attack, etc. The practical behaviour of the material was, however, the final and best test.

High-Duty Iron and Refractory Life

MR. BUTTERS asked whether the lecturer could explain why there should be such a wide difference in the quality of ganister delivered. Personal experience was that the quality varied widely from truck to truck. The present cupola lining would only give one-quarter the life of the previous one.

With reference to the melting of high-duty irons, the lecturer had asked why was this carried out early in the heat when it was obvious that the life of the refractories would be extended if the material were cast later in the heat when the cupola refractory was at a higher temperature.

Mr. Butters explained that personal experience indicated that it was much easier to keep the various cupola charges separate when using iron of various analyses, if the high-duty iron was melted first. He finally asked the lecturer if consignments of ganister were checked before delivery.

Quality Maintenance

MR. HARBACH, confirming the complaint made by Mr. Butters, said that though the lecturer had pointed out that ganister was checked, did he mean for chemical *and* physical composition, as in his opinion both were equally important? A good physical composition was useless if the chemical composition was inadequate for the service requirements, whilst if the chemical composition was satisfactory, wrong proportion of fine, coarse and lump would also spoil a cupola ganister.

Following complaints that a delivery of ganister lacked "body," samples were sieved and graded, and the result showed a deficiency of small lumps. On another occasion small pieces of crushed house bricks were found in a similar test.

Wet Ganister Recommended

MR. OAKES said that some users asked for dry ground ganister in place of the graded wet ganister, which gave the best results, as it was properly prepared in a special mill, whereas, when sent out dry, the final mixing and milling were not satisfactory. Another disturbing factor was that the patching was often left too long before being attended to, and the quantity of patching material required to straighten up the cupola was excessive, resulting in extra trouble in drying out and at the same time not giving the ganister a fair chance. The refractoriness, chemical analysis, grading and plasticity of the ganister were checked regularly in the laboratories of the large producers.

Dolomite as a Flux

MR. DUNLEAVY expressed the opinion that the severe criticisms made in this discussion were due to the foundryman's opinion that the refractories were not of a consistent standard, required to maintain the continuous flow of production present conditions demanded.

So far as the question of foundry sand was concerned, he understood the lecturer preferred that the foundry industry should use synthetic sand rather than the familiar red and yellow sands. Was it because some sands were difficult to obtain, or was it because the refractory manufacturers had no time to prepare the natural sands?

Did the use of dolomite with the limestone produce a slag which was very similar to that created by soda-ash? The question of using dolomite has been previously discussed at a meeting of this Branch, but it was never thrashed out, being chiefly concerned with steel. He was not interested in steel, but with cast iron in the cupola. He did not experience any trouble with ordinary limestone, but had encountered it when using a dolomite limestone mixture.

Finally, Mr. Dunleavy asked if the lecturer could suggest an easy and efficient method of checking the moisture content of the refractory composing a monolithic lining, which could be safely left in the hands of the workmen when using this material either for relining or patching a rotary furnace or cupola.

Why Synthetic Sands are Used

MR. OAKES said the maintaining of a consistent standard of refractories was the aim of all makers, the keeping up of the high standard attained before the war, however, became increasingly difficult owing to raw material and transport problems.

Where the local red and yellow sands were giving satisfaction, there was no need to employ a synthetic sand. The demand for sands with a higher refractoriness, green strength and permeability could not always be made by a single quarry sand, and synthetic sands had then to be supplied. These sands could be kept consistent to comply with the more rigid specifications now employed.

Dolomite was rarely used in the iron foundry, limestone being more easily obtained in most districts. Where dolomite was used in the cupola, it should produce a more fusible slag, but whether it compared with that produced by soda ash he could not say.

The quickest method was by the use of the Speedy moisture tester, but the most accurate way was the original laboratory one of weighing out a quantity and drying in an oven at

10 deg. C. The moisture content of monolithic lining material when despatched was from 5 to 6 per cent. Three to four per cent. was the best for ensuring a tight, even ram. The higher moisture content in the material would allow for the loss during transport and operation.

Rotary Furnace Maintenance

MR. READ asked the lecturer what he would consider to be a fair average life of a monolithic lining of the "Rotaline" type in (1) a one-ton capacity rotary melting furnace melting only high-duty iron, and (2) a half-ton rotary melting furnace for gunmetal and bronze. He also asked whether the lecturer could suggest a successful method for the patching of rotary furnace lining.

Reply to Mr. Read

The length of service obtained from a rotary furnace lining was to a large extent dependent upon the amount of patching undertaken. Some users of rotary furnaces, however, insisted that whilst patching prolongs the life of the lining it was not always economical. Other users held exactly the opposite view. No doubt this question of whether patching was economical or not depended to a large extent on if there was a spare ready-lined furnace barrel standing by, which could be quickly slung into position immediately the barrel containing the worn lining had been removed. In these days of maximum production, no doubt this was the most economical way of running a rotary furnace, because production was hardly interrupted at all and very little valuable time was lost. Immediately No. 1 barrel had been taken out of commission, it should, of course, be stripped of the old lining, be re-lined, and partly dried out.

If only one furnace barrel was available, however, it might be essential to patch the lining in order to keep the shop on production and to interrupt the flow of the work as little as possible. The patching could be done either whilst the lining was hot or after it had cooled down, but whichever method were used, it was advisable to drain off as much slag as possible before the patch was applied.

In the case of hot patching, this could be done with either a plastic or dry material. If a plastic were used, it could be applied in a similar manner to a patch in a cupola, but care should be taken that the patch was not too thick, otherwise it might break away from the original lining. It was better to apply two layers of material, allowing the first to dry out slightly before the application of the second, than one thick patch. When dry material was used for hot patching, only a thin layer should be applied and consolidated with the aid of a rabble or similar tool. When the material had adhered to the original lining, a further layer could be applied, and so on until the desired thickness had been built up. It might, during the course of these applications, be necessary to have the furnace under fire so as to burn in or frit the new material. Although dry patching required more skill than when material is applied in a wet condition, a dry patch or frit usually gave better results providing it was applied correctly.

A one-ton rotary furnace melting high-duty irons usually gave a lining life of between 150 and 200 melts, depending upon the amount of patching, whilst a half-ton furnace in which gunmetal and bronze were being melted gave a life of between 450 and 500 melts.

Silica Bricks in Cupola Practice

MR. PAYNE expressed surprise that silica bricks carrying as they did a silica content of 92 per cent. or more, should be advocated for a cupola lining in view of the well-known changes of volume occurring during the heating up and cooling down of silica.

The heating-up cycle in cupola practice was fairly rapid, whilst the cooling cycle on dropping the bottom was drastic. This cooling was accentuated by the chimney effect of the cupola drawing a rapid draught of air, and by the steam arising from the quenching drop. He concurred with the previous speaker's statement as to the need for further investigations to meet the varying conditions at varying levels of the cupola stack.

Had the lecturer any knowledge or experience of the use of synthetic refractory materials, such as silicon carbide in the cupola in this country? The speaker had noticed some obscure reference to such a trial having been carried out in a blast furnace on the Continent.

A Neutral Refractory Sought

Had the refractories trade seriously set out to produce a lining of the more neutral type to overcome the difficulties experienced when using such fluxes as fluorspar or soda ash in the cupola? The control of sulphur pick-up was attempted by using these materials with the cupola charges. The limiting factor as regards the effective quantities of such fluxes used, was the harsh scouring effect upon the lining, although in the speaker's opinion they were more efficient than the usual limestone flux; the quantities permissible with the normal cupola linings did not make this efficiency at all apparent.

MR. OAKES pointed out that the refractories manufacturers did not recommend silica brick linings for cupola owing to the sudden rise and fall in temperature especially in the drop-bottom type. In the case where receivers were used, possibly good results could be obtained. The quartzite type of silica brick with about 93.5 per cent. silica and higher alumina and iron oxide than the ordinary steel furnace brick, having a greater resistance to spalling, had been tried with varying results in cupolas with receivers. He regretted he had no first-hand knowledge of either silicon carbide or neutral bricks being used in cupola practice.

Vote of Thanks

MR. H. J. BECK, Senior Vice-President, in proposing the vote of thanks, said, judging by the interest created during the discussion, the Paper had stimulated the members and they had brought forward a number of complaints which the refractory manufacturer would no doubt seriously examine. He appreciated the difficulties in meeting the requirements of the foundries under present conditions, and any assistance that could be given would be gratefully received.

Mr. Beck had purposely refrained from joining in the discussion because the last occasion when a Paper on this subject had been discussed in the Branch he was in trouble owing to expressing his views too forcibly, but it gave him very great pleasure to propose a hearty vote of thanks.

MR. T. GOODWIN, who seconded the vote of thanks, thought the Paper had served its purpose by encouraging the members to air their grievances regarding refractories in such a manner that they could be carefully considered by the manufacturer. His own experience did not permit him to agree with all the lecturer had said, but he was pleased to second the vote of thanks.

MR. OAKES suitably replied.

New Swedish Alloy Steels

New alloy steels for structural purposes, with a very small nickel content or no nickel at all, have been developed in Sweden on account of the difficulties in importing sufficient quantities of steel, according to Einar Ohman, Swedish mining engineer. Since the beginning of the war, co-ordinated research has been carried out at the various Swedish steelworks, which has resulted in alloys containing mainly manganese, chromium and, in certain cases, molybdenum. In evolving the new alloys the Swedish metallurgists have partly been guided by experience gained in America and Germany in connection with the production of cheaper and simpler steel.

Iron and Steel for the Colonies

A circular issued by the Colonial Office to export merchants outlines the procedure to be followed in connection with the placing of commercial orders for the supply of semi-manufactured iron and steel products to the Colonial Dependencies. It is emphasised that applications for supply licences can only be considered in cases where the importer in the Dependency holds an import licence from the local Government authorities. Firms here should ascertain first, therefore, that a Colonial Import Supply Licence has been granted by the Government licensing authority concerned covering the particular goods on order. Firms should then complete an application on the appropriate Board of Trade (Export Licensing Department) or Ministry of Supply (Iron and Steel Control) form. The application, in duplicate, together with any supporting documents, should be forwarded direct to the Under Secretary of State, Colonial Office, Downing Street, London, S.W.1.

Firms will be informed of the result of their applications as quickly as possible. Having regard to the supply and shipping position, it is contemplated that a large proportion of the orders will be diverted to America; and in order to comply with the requirements of the United States Government it will be necessary for such orders to be placed with the British Purchasing Commission there. The British Iron and Steel Corporation has been nominated by his Majesty's Government to co-ordinate the American purchases. The Corporation will be responsible for the marshalling of all orders for supplies to the Colonial Dependencies emanating from the United Kingdom; the presentation of the orders to the British Purchasing Commission in America; the placing of the contracts with the United States manufacturers; and finally the shipment of the completed orders, if possible, direct to the Dependency concerned. The collation of orders in the United Kingdom will be undertaken by D. Cameron & Company, of 40, Lime Street, London, E.C.3, on behalf of the Corporation and, on the receipt of a notification that an order is to be placed in the United States, firms should communicate with Mr. David Cameron, who will advise them of the further detailed needs.

The circular gives the following list of semi-manufactured iron and steel products to which the foregoing procedure applies:—Ingots, billets, blooms and slabs (excluding shell steel); plates, medium plates, angles, channels, tees, joists, piling sections, or other sections material, rounds, rods, squares, hexagons, flats, other sections and shapes (and whether black or bright), rails, sleepers, fish-plates, soleplates; sheets coated and uncoated, less than 3 mm., including galvanised, lead coated, R.P.M. and cellactite sheets; tinplates (including tinned sheets), black plates (including silver finished plates); steel tubes and pipes (including imported hollows); hoops, strip (and whether coated or uncoated, and whether hot or cold rolled); tyres, axles, wheels; steel castings; forgings, stampings; colliery arches and accessories therefor, pit props; steel bolts, nuts, screw studs, washers, rivets and screws; railway springs (and whether laminated or coiled); buffers; wire rods, coated or uncoated wire, whether plain or barbed; wire rope; wire strand; wire netting; wire chain link fencing; wire mesh; wire nails, excluding boot and shoe grindery; wire staple, excluding machine staple; constructional steel, whether fabricated or not, for inclusion in the structure of a building; pig and foundry iron, iron castings and wrought iron.

Applications should be made out on an Export Licensing Department form, except in the case of tubes and pipes, steel castings, forgings and stampings, and bolts, nuts, screw studs, washers, rivets and screws, when the Ministry of Supply (Iron and Steel Control) B.T.5 form should be used. The new procedure does not apply to hollow drill steel, applications in respect of which should be made through the Sheffield Hollow Drill Steel Manufacturers' Group, Williams Deacons Bank Chambers, Church Street, Sheffield, 1. An export licence is required.

Factory Emergency Lighting

A four-page leaflet received from Philips Industrial, Century House, Shaftesbury Avenue, London, W.C.2, describes and illustrates plant specially designed to provide lighting in factories and foundries under any special condition of emergency that may arise.

Concerning Scrap Losses

By R. F. COATES

Heavy demands are imposed on all branches of engineering by war conditions. Almost without exception, its products are directly or indirectly essential to the war effort. To effect a maximum of production, every effort must be made to yield positive results. Scrapped parts are losses both of production time and money. At the present time the average foundry is called upon to produce castings of a higher standard than that of the last decade. Moreover, these requirements have increased the difficulties of scrap problems; the modern foundryman has a wealth of scientific data available to assist him in controlling almost every phase of casting production.

To most foundrymen, scrap is of necessity, an accepted fact. This is chiefly due to the variable factors involved in producing castings. Theoretically, if a moulder makes ten castings off the same pattern, using the same materials, and under the same moulding conditions, providing, of course, that the materials are suitable for the job, 100 per cent. production should result. Yet as every foundryman is aware, this is not always so. One or more of the variables becomes uncontrolled during the course of production, and results in a waster.

It is only by keeping wasters and their *cost* in mind that progress is made toward reducing them. However low a percentage of scrap is made, the aim must be still to eliminate completely.

Castings are produced by a series of operations performed by the coremakers and moulders, supplied with suitable materials to produce cores and moulds. Finally there is the metal to form the casting, and the work of the fettler to make the casting presentable to the machine shop. The cause of wasters, therefore, lies between these stages of production and the foundry supervision.

The supervisory staff of an average foundry and the stages of production for which they are responsible are shown schematically below. It is by each supervisor exercising strict control over his department and materials, and by collaborating with other members of the foundry staff, that most happy and positive results are obtained. The scientific study of each foundry operation must result in a greater efficiency, with a consequent higher production rate, bringing in its wake greater profits.

If the percentage of scrap is too high, then doubtless the foundry concerned is operating at a loss. It is only by thorough supervision and management that scrap losses will be kept within reasonable limits.

One of the greatest incentives to reduce such losses is to account as accurately as possible the loss in terms of cash. If, for example, a foundry is producing on an average 50 tons per week, with an average scrap of 6 per cent., and assuming that the casting value is 3d. per lb. (*i.e.*, £84 weekly), the reduction of scrap to 3 per cent. will then represent a direct saving of £42. These figures show the importance of keeping scrap losses to a minimum. Such a saving will easily turn losses into profits, and amply repay any efforts which may be made to effect the reduction.

In considering the loss on an individual casting made under jobbing methods and scrapped, the details of which are given in Table I, it will be noted that the replace casting does not, as one might suppose, cost the same as the original casting. This is due to the fact that the scrapped casting is still available for remelting as "home scrap." To this, however, must be added the cost of remelting, which gives the final figure of £2 0s. 3d. as the total loss on a 5-cwt. job. Under repetition methods of production, assuming that the cost of production is halved, there will, however, be an extra percentage of costs in overheads to cover extra mechanical plant. Details of this are given in Table II.

Figures again illustrate forcibly the attention that scrap losses should receive. Machine shop scrap losses are, of course, even more costly than those of the foundry, for not only has the cost of marking out and machining been incurred, but also the overheads of the machine shop, progress and transport departments, who have handled the casting between it leaving the foundry and its arrival in the machine shop. A certain percentage of machine shop scrap is naturally due to faulty machine shop practice, and, of course, does not concern the foundry.

Close collaboration between machine shop and foundry staffs is essential on foundry scrap problems. When castings are scrapped in the machine shop, it is a good plan, when returning them to the melting department, to accompany them with a report from the machine shop foreman, as this gives the foundry management an opportunity to inspect these from the machine shop angle before remelting.

Assuming that the supervisory staff shown in the scheme depicted forms the committee of inspection, each supervisor can take up with his own department and check up on his materials, in so far as the waster in question applies to his activities. A scrap chart, recording weekly percentages, also serves a useful purpose, as it will immediately show any undue rise in scrap. It will also provide a basis upon which losses can be estimated.

The conclusions are that, although a loss, scrap can serve a purpose in so far as it is experience bought and paid for. Like everything else, however, it should be purchased at the most economical price; in other words, with a low percentage of wasters.

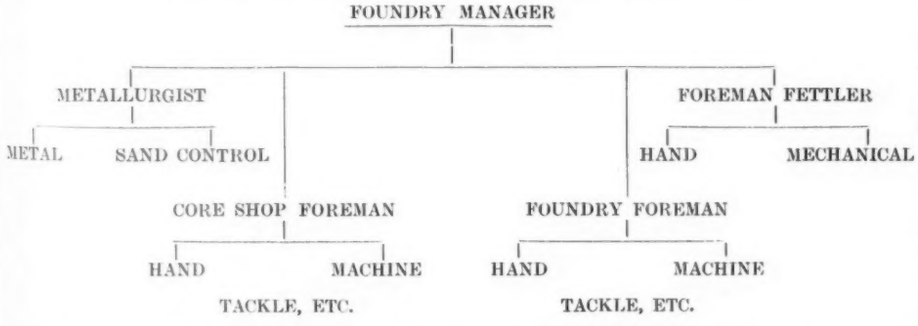
TABLE I.—*Cost of Making a Replace Casting Weighing 5 Cwt. by Hand Moulding.*

Original Casting:	£ s. d.	*Replace Casting:*	£ s. d.
Casting; mould and materials—*A* ..	1 0 0	As original	2 16 0
5 cwts. of metal at spout at 80s. per ton ..	1 0 0	Less value of scrapped casting, 5 cwts. at 70s. per ton	17 6
Overheads, 80 per cent. of *A*	16 0		1 18 6
		Plus cost of remelting above	1 9
	£2 16 0	Loss on job	£2 0 3

TABLE II.—*Cost of Making a 5-Cwt. Casting Under Repetition Conditions.*

Original Casting:	£ s. d.	*Replace Casting:*	£ s. d.
Casting; mould and materials—*B* ..	10 0	As original	1 19 6
5 cwts. of metal at spout at 80s. per ton..	1 0 0	Less value of scrapped casting 5 cwts. at 70s. per ton	17 6
Overheads, 95 per cent. of *B*	9 6		1 2 0
		Plus cost of remelting above	1 9
	£1 19 6	Loss on job	£1 3 9

Table showing Human Factors in the Production of a Casting.



Germany's Second Four-Year Plan

At a meeting in Vienna of the Arbeitstagung für industrielle Wirtschaftsführung on January 15, State-Secretary Paul Körner discussed the second four-year plan, with special reference to industrial conditions in the Ostmark, and the achievements of the Reich in the first four-year plan. In the course of his address he emphasised the need for more arms, war materials and munitions in order to maintain the lead which had been established over the democracies. This will require new workshops, improved methods of production, new machines and the training of a skilled labour force. The second important need to be filled in the second four-year plan was a further expansion of Germany's raw material basis. As regards labour, Körner reported that the bulk of German labour was concentrated on war needs. The dissipation of effort in other directions was a weakening of Germany's war potential. At all works every worker must be fully employed, if not the worker or workers in question must be transferred to where they would be fully employed. Labour must not be retained by works which can be dispensed with now, in the hope that such labour will be required in the post-war period. Peace will bring its labour difficulties, for there is every sign that there will be a serious shortage of labour in Germany after the war, "to cope with the work to be done in building up the conquered territories, such as those in the east and west which will be incorporated in the Reich, as well as in the Ostmark." Further rationalisation and technicalisation of all Germany's industries will alone solve the problem.

Tin in Foundry Practice

The Annual Report of the Tin Research Institute contains a number of paragraphs of outstanding interest to the foundry industry. Reference to several of these matters is made in the following extracts.

Electro-Deposition of White Tin Bronzes

Laboratory work has been concerned mainly with solving troubles arising in full-scale working and with determining the best proportions of tin and copper for different purposes. The best composition of the alloy deposit for resistance to atmospheric tarnishing is found to be 40 to 45 per cent. of tin, the balance being copper. White bronze appears on the whole to be slightly less tarnish-resistant than chromium, but is more easily repolished. On articles such as spoons and forks, which are regularly rubbed and washed, there is little or no loss of brilliance.

Technical development of white bronze coatings has been hindered in this country by wartime lack of interest in a decorative process, and in America by patent negotiations now nearing finality. However, two new plants have been installed in this country, and others are being discussed. In U.S.A., a lively interest has already been shown. A demonstration plant is installed at the Battelle Memorial Institute and will be available for plating samples as soon as the patent situation has been clarified. This should follow closely the completion of the American patents, now under discussion between the American authorities and the Institute's patent attorneys.

In countries where no patent restrictions interfere, a start has been made. An experimental plant is operating in the Argentine; full working instructions have been sent to firms in Australia, Eire, India, Kenya, Malaya, New Zealand, Palestine, Portugal and South Africa; also to France and to Italy in the early part of the year. These inquiries are being followed up, but, owing to the slowness of communications, details of the present position are not available.

Tin-Rich Alloys

Fundamental investigations on the properties of systematically chosen groups of new tin-rich alloys have been continued, since it is from this work that new compositions of alloys for bearing metals, solders, pewter and other applications can be selected. Most of the new alloys studied have been obtained by adding small amounts of other metals to the ternary system tin-antimony-cadmium, and a number of them have been used in the bearing metal researches described below.

The properties of many alloys in this system can be varied by heat-treatment, and during the year new heat-treatments have been devised, so that it is now possible to obtain at will a fair range of properties from one and the same alloy composition. In some directions the properties of several of the heat-treated, tin-rich alloys are quite outstanding. The present position is that, by suitable choice of composition and heat-treatment, alloys of desired properties or combination of properties within a fairly wide range can be made. Many of the alloys having higher strength and hardness than known tin-rich alloys at the ordinary temperature, have relatively still better properties at temperatures up to 140 deg. C. Moreover, in many cases the improvement effected by heat-treatment is retained undiminished after exposure to heat at 140 deg. C. for 1,000 hrs. These facts are likely to be important in the application of the alloys to bearing metal practice, where temperatures of this order are maintained for long periods.

Research on the constitution of tin-antimony-copper alloys containing up to 3 per cent. of copper and up to 14 per cent. of antimony is completed and will be published in due course.

Bearing Metals

The year's progress may be summarised as follows: The fundamental work on tin-rich alloys has provided numerous alloys, covering a wide range of properties. The properties now determined in the laboratory as a matter of routine for each alloy under several different conditions of heat-treatment are hardness, tensile and shear strengths, melting point, adhesion to steel and other backing materials, friction coefficient against steel in oil, and resistance to cracking by rapidly repeated impact or flexure. By systematic determination of the numerical values of these properties and comparison with microscopical examination of the structure of the alloys, it has become possible to vary the properties over a certain range at will by making small changes in their composition. The properties may also be varied to a known extent by different heat-treatments. There thus exist a great number of combinations of alloy composition and heat-treatment from which to select bearing metals for different purposes. The missing link is the knowledge of what combination of properties is required to produce the best bearing metal for a particular purpose.

It seems probable that this knowledge can only be acquired by engine tests. In present circumstances the opportunities for such tests are few, but those that have been carried out have given encouraging results and pointed the way to further progress. They warrant the hope that in the coming year considerable progress will be made in the practical application of the knowledge provided by last year's work. Already the Institute is in close and constant collaboration with two important bearing metal manufacturers and have gained the keen interest of a number of leading motor-car and aircraft engine manufacturers.

Adhesion. — The factors determining the strength and soundness of the bond between the bearing metal and its steel or bronze shell are becoming better understood as a result of a great number of measurements of tensile and shear strengths at the bond, coupled with X-ray identification of the broken bond surface, and experiments on varying the technique of lining the bearing.

Attention has also been devoted to the practical methods available to the industry for assessing adhesion value. At present, manufacturers rely on a rough chisel-and-hammer test, but in the course of the year's work it has become clear that this test depends largely on a personal factor, and in some cases may give misleading information. A reliable quantitative laboratory test has already been devised, and it is hoped to be able to adapt it for the use of manufacturers.

A Sea-Water Bearing.—Research was undertaken to find an alloy more suitable for ships' underwater bearings than the alloy at present in use. Tests showed that several new alloys developed in the Institute's laboratories had superior mechanical strength, hardness, anti-friction properties, and corrosion resistance in sea-water. The performance of selected alloys was then compared in an experimental machine which reproduced the conditions of interaction between a ship's propeller shaft and the bearing in aerated sea-water. As a result, one tin-rich alloy of quite outstanding superiority containing a higher percentage of tin than that now used is recommended.

Pewter

Among the large number of new tin-rich alloys examined, two containing over 90 per cent. of tin have been selected for development as new improved pewters. These alloys can be easily cast, rolled, spun and soldered, but their chief advantage is that they can be fabricated in the soft condition and then heat-treated so as to increase their strength and hardness, giving values which are 60 per cent. and 85 per cent., respectively, higher than the commonly used pewter alloys.

Owing to the war-time lack of interest in pewter in Europe, full details for the preparation and working of the new alloys have been sent to the Battelle Memorial Institute, where arrangements are being made for trials by interested firms.

Bronzes

It has been known for some time that bronzes can be improved for many purposes by increasing the tin content within limits, but in the past the difficulty has been that the use of bronzes containing more than about 7 per cent. of tin has been restricted to castings as the alloys have been difficult to extrude, roll, or draw. Further, most cast bronzes were more or less porous.

In recent years, conditions for casting sound, workable bronze of high tin content have been discovered, but are not well known in the industry. The technique is now being tried out in collaboration with a firm in Birmingham with the object of developing the use of the improved bronzes in rolled and drawn forms, for valve guides, worms and gears, condenser tubes, paper-making gauzes, etc.

Bronzes having still better properties for many purposes have been made in the laboratory by adding small quantities of aluminium and casting by a new technique. The rolling properties of these alloys are extraordinarily good, and their mechanical properties in the annealed condition are superior to those of the best alloys in use for condenser tubes; corrosion resistance remains to be determined. As a guide to the selection of alloy compositions, the constitution of the series of alloys containing 5 to 18 per cent. of tin and nil to 7 per cent. of aluminium has been worked out. Preliminary corrosion tests in sea water suggest that the alloys may be particularly useful as condenser tubes. More extensive tests on corrosion resistance are now being conducted.

Vitreous Enamel Industry

The first year's work arranged with the British Cast Iron Research Association has been devoted to a survey of all the literature relating to the use of tin oxide as an opacifier in vitreous enamels, to consultations with representatives of the industry on the relative advantages of tin oxide and other opacifiers, and to the collection, construction and trial of apparatus which will be used during the coming year in experimental investigations of the best conditions of use of different kinds of tin oxide.

Observations on Cast-Iron Enamelling

(*Concluded from page* 380.)

remarks on hydrogen inclusions were very interesting, but X-ray examination of rejected castings had recently shown no gas inclusions, while some perfectly enamelled castings had shown gas holes.

MR. BIDDULPH thought that, while the copper inclusions no doubt helped the chilling effect to be eliminated, in the case of the increase in pressure resistance, this was possibly due to the sealing effect of the enamel coating. With respect to hydrogen inclusions, he personally was still rather sceptical as to their effects.

MR. J. S. KIDD (Camelon) corroborated Mr. Biddulph's remarks on the application of rock sand to certain parts of troublesome castings.

MR. BIDDULPH added that he had seen cases where extra large lugs had given no blistering trouble, whereas smaller ones had.

After other members had contributed to a general discussion, Mr. Biddulph was accorded a very hearty vote of thanks, to which he briefly replied.

The South African Engineering Industry at War

4—AIRCRAFT BOMBS AND DEPTH CHARGES

By A. G. THOMSON, Editor of "Engineer and Foundryman"

Heavy Aircraft Bombs

Almost from the very beginning of the war the production of heavy aircraft bombs has been in full swing. In a Rand foundry the author witnessed the casting of the largest and most powerful bombs which the South African Air Force is at present using.

The plant has been fully mechanised and includes two jolting machines built especially for moulding bombs. The bomb boxes and patterns had to be designed and constructed on the premises, and it was also essential to determine the correct sands to use, special sands being particularly necessary for the cores. Not till after two months of experimental work could production be commenced. The greatest difficulty was experienced with the patterns, which are made of aluminium. A small runner was originally used. This proving inadequate, the size of the runner was doubled and ultimately it had to be doubled again. Finally, a feeder had to be put on the opposite side of the pattern in order to eliminate seeping. Particular care is taken in the setting up of the mould to ensure that there is an even thickness of metal throughout.

The furnace used is a 4-ton basic lined Héroult type furnace. Four tons of bombs are cast at every heat. About three-quarters of an hour after casting the bombs are opened up to facilitate contraction. The runners and heads are cut off, after which the castings are fettled by means of pneumatic chisels, etc. They then go into the annealing furnace in order to facilitate machining.

This concern supplies two mine workshops with castings to be machined, and also carries out machining operations in its own establishment. The bomb is inserted in a cradle in the machine and the feeding head is faced off. The nose and base of each bomb is machined and the interior ground. The nose is bored out and screwed, and the bomb then goes to a drilling-machine to be drilled for the suspension lugs. Next it is tested at 30 lbs. air pressure in a tank of water. At this stage it is passed or otherwise by the inspector, the number of rejections being extremely small. If up to standard it is sand-blasted, and is then sent away to be varnished inside and painted on the outside by specialists.

After a second inspection the bomb is brought back again and taken to the fitting shop to be assembled. The lugs are attached by welding. A central tube and a filling plug are fitted, and a tail socket screwed on to the central tube to support the tail fin. Then the central tube is welded on to the bomb. A locating screw is provided in order to keep the tail in the desired position. These various components are all the products of local engineering firms. After assembly the bomb is subjected to a final inspection and is then crated in readiness for dispatch.

A Smaller Type of Bomb

Special equipment was also needed for casting the smaller types of aircraft bombs, since it proved impossible to adapt existing plant and machinery to any great extent. Nevertheless, with the exception of a Rollover-jolt pneumatic moulding machine imported specially from Australia, all the equipment at the first establishment where these bombs were being manufactured had been made locally; including, of course, the moulding boxes. All the moulds used in the factory are machine-made. Aluminium patterns and core-boxes are used and bombs are cast in batches of fifty. Handling has been eliminated as far as possible.

Interesting features of the process are the use of a metal chill against the suspension lug pad, and the fact that the boxes are designed to take the bombs in pairs. Another point is that the core is made integral with the baseplate, the whole being dried together.

The setting of the mould in relation to the core in order to ensure concentricity proved very important, as did also the placing of the ingates and the risers. Considerable experimental work had to be undertaken before either of these two problems was satisfactorily solved. Very careful attention is given to the quality of the steel, and the finished casting is subjected to pneumatic pressure tests for soundness. Another important point is the necessity for a very clean finish in order to take the varnish.

To a large extent methods of casting are governed by the plant available. The second concern visited had imported two moulding machines from the United States for bomb production, and the process adopted differs in several important respects from that previously reported upon. In the first place the boxes are made to take the bombs singly instead of in pairs, while a second variation is the use of a self-centring plate to ensure that the two halves of the moulding boxes are accurately closed.

The following description of the methods adopted in this establishment affords an insight into the number of different operations involved in the production of aircraft bombs before the castings are ready to be machined.

The aluminium patterns and core boxes, together with the moulding boxes and plates, are made in the foundry and sent to the machine shop to be specially machined Each pattern passes on to the steel foundry, where it is bolted to a moulding machine. Next a moulding box is fitted to the pattern and filled with special sand. The machine is set in operation and jolts the box, after which the box is swung over and the pattern withdrawn from the mould. The sand moulds are then loaded on carriages and put in ovens, where they are dried at a temperature of 250 to 300 deg. C.

The core boxes are sent to the core shop, where the sand cores are made from them by hand. A steel pipe is bolted to the self-centring plate and wrapped with grass rope. This pipe serves to support the sand core, and to lead away the gases liberated during casting. The core box is mounted on to the plate and hand rammed with special core sand. The final result is a perfect core mounted on the plate. The cores are put into drying stoves and dried.

The complete unit, comprising the sand core and moulding boxes, is assembled and the metal is duly poured. Two heats are necessary to complete the day's production. After casting, the moulds are stripped and the castings are taken to the welding shop to have the risers cut off by oxy-acetylene torch, and to the machine shop to have the heads cut off by power saws. Next they are passed on to the fettling department to be cleaned and sand-blasted. An interesting feature of the fettling department is a special type of rumbler in which the bombs, filled with pieces of jumper bits, are rotated. This process ensures that the interiors of the castings are perfectly clean and smooth.

After fettling, the castings are submerged in a tank of water and submitted to an air test of 30 lbs. per sq. in. pressure. Any flaws which may be present are readily detected by the bubbles given off. A further sand-blasting follows the testing, to ensure that no trace of water remains, and the bombs are then ready to be sent elsewhere for machining. All castings have to be of an even thickness throughout and must also be within certain limits of weight.

Machining and Assembly

The machining of the castings and the assembly of the bombs is carried out in mine and railway workshops throughout the country. In one of the largest establishments in the Union the writer was shown some of the many machining operations necessary before the castings are ready to be fitted with the various components required to convert them into highly efficient engines of destruction.

The first operations are carried out in a machine in which the nose of the casting is centralised by means of three spigots, while the tail is securely held by three dogs. A cut is first made across the face in order to obtain the specified distance from the tail end to the suspension lug on the side of the bomb. A special tool then swings into position and carries out two operations, boring out the hole in the tail-end of the bomb and forming the inner collar simultaneously. The hole in the tail-end is screwed and tapped, and a recess is cut on the outside for the actual tail.

The bomb is then transferred to a second machine. Into the tail is screwed an ordinary plug adaptor, which fits in a bush in the spindle of the lathe, and the casting is drawn tightly against this bush by means of a hand wheel at the back of the hollow spindle. This ensures that the machined portion of the tail end of the bomb and the nose will run concentrically. The diameter of the head is now reduced, the nose being shaped off to meet the contour of the bomb body. A facing cut is taken across the end of the nose, the accuracy of the overall length of the bomb being ensured by stops in the machine.

The bomb is next taken to a drilling machine, where a hole is bored in the nose and tapped through, the threaded portion being cut to length on the outside. This completes the lathe operations on the body, which at this stage is inserted in a drilling jig. Four holes for the suspension lugs are machine-drilled and tapped, and while the bomb is in the jig a hole is also drilled in the tail for the tail locating pin.

The bomb is now ready to be tested. An adaptor is screwed into each end, and an air pressure of 30 ibs. per sq. in. is applied. The casing is immersed in water for a minute, and is discarded should any leakage be observed. Very few leakages have occurred.

Before assembly is begun the interior of each casing is carefully examined to ensure that no holes or sharp edges are present. A tap is also put through the tail hole to make certain that the diameter has not been affected by the stresses set up during the machining operations. A filling-plug is then screwed into the tail end, and a gland-ring fixed in position so as to ensure that the charge will be tightly sealed. Both the filling-plug and the gland-ring are turned from the solid.

* Previous articles on the war activities of the S.A. engineering industry appeared in the FOUNDRY TRADE JOURNAL of March 13, April 24 and May 29 last.

The central tube, which is really the detonator holder, is screwed into the nose bush and spot-welded into position with three spot welds. Here again care must be taken to avoid all sharp points, the welds being carefully smoothed off. The actual tail can now be fitted. This is made of sheet metal and is provided with a steel corering which fits the tail end of the bomb body. A small set-screw retains the tail pistol in the tail-securing bush, while another set-screw holds the tail-securing bush on to the central tube. A third set-screw is located at the nose to hold the nose pistol in position.

Fuse Mechanism

The fuse mechanism consists of a body which is in two parts and a copper-plated steel central striker, secured in position by means of a shearing-pin which goes right through the body. An important part of the mechanism is a safety fork, next to which is a pressure plate with eight notches into which a tiny spigot in the safety-fork can enter. A cover, which is screwed to the striker, protects the striker from being accidentally released, while another of the principal components is an aluminium propeller secured to the cover.

The operation of the mechanism is as follows: When the bomb is in position the operator pulls a cord and withdraws the safety fork. The aluminium propeller spins the cover and itself off as the bomb falls and both parts drop away, exposing the striker and pressure plate, which on contact with the objective, shears the shear-pin, and strikes the detonator.

It is interesting to note that the aluminium propeller is a die-casting, the striker itself is turned from the solid, the cover and pressure plate are brass drop forgings and the shear pin is made of soft copper. The other parts are all of brass.

Anti-Submarine Bombs

The principal differences between aircraft bombs and anti-submarine bombs (or depth charges) are that the bodies of the latter are built of ordinary mild steel plate, which is assembled by welding throughout, and that the tail adaptors of anti-submarine bombs are not steel castings but drop forgings. The chief reason for such a wide divergence in methods of construction is that thick casings are not necessary for anti-submarine bombs, the pressure of the water serving the same purpose as the thicker walls of aerial bombs.

In the production of tail adaptors the forgings are first drilled. The next operation is carried out with a tool which forms a recess and at the same time bores the holes to size. The hole which holds the nose container is now tapped, after which the outside contour of the tail adaptor is shaped with a form tool. The forging is now reversed and the rag left by the turning operation removed. This section of the job is then complete.

The body of the bomb is pressed in two halves in a hydraulic press. The nose is machined and screwed. The nose and tail adaptor are placed in position in a welding jig and the two halves of the body fitted. All four components are then welded together. In this type of bomb the suspension lug is welded directly on to the body.

Into the nose of the bomb is inserted a very heavy nose plug, which is turned from the solid, drilled, screwed, and fixed in position. Formerly the nose container was produced from the solid, an operation which took approximately 3¾ hrs. Now a new method has been evolved which has reduced the time by considerably more than 50 per cent. The container is now built up of three parts, viz., a screwed end, tube and disc. The screwed end is turned from a solid bar and machined all over. A Transvaal engineering company supplies tubes drawn to the limits required. These are first cut to length and then inserted and welded into a recess left in the screwed portion of the container. A disc turned from the solid is held tightly against the top end of the tube and welded to it. The unit is then taken to the machine-shop, where the welded portions of both the screwed end and the disc end are machined. It is then subjected to an air pressure test of 100 lbs. per sq. in., after which it is cleaned up on the outside and the bore is reamered to size.

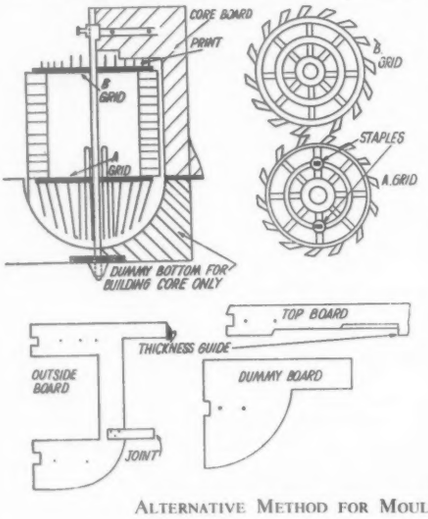
The complete unit screws into the tail adaptor, and the detonator holder which contains the bomb pistol is screwed into the container.

In this type of bomb the tail is not secured by means of a screwed bush, but is clipped into position by springs.

Moulding a Diesel Engine Silencer

By MOLA.

In looking over some back copies of the FOUNDRY TRADE JOURNAL, the writer was interested in an article entitled "One Way of Making a Loam Casting," which appeared on page 85 *et seq.* of the current volume. Mr. Potter rightly stresses the need for visualising the job before embarking on any pattern-making or moulding. This having been done, the present author suggests that the method disclosed might result in cracked castings, owing to the inherent difficulty of the rapid easing of the casting—a matter of some importance with a casting carrying only a half-inch metal section, bricked up interiorally. For instance, Plates Nos. 7 and 9 cannot be removed from the casting except by breaking, and this can be a tough proposition when they cannot easily be attacked. Moreover, when cast in the position shown, there can only be a very small vent at the bottom; thus the gas would first rise and fill the core before descending. If this gas be not lit at the correct moment, a back draft might easily cause bits to be blown off the top of the core by the explosion. If metal did happen to enter the vent, this seems bound to occur.

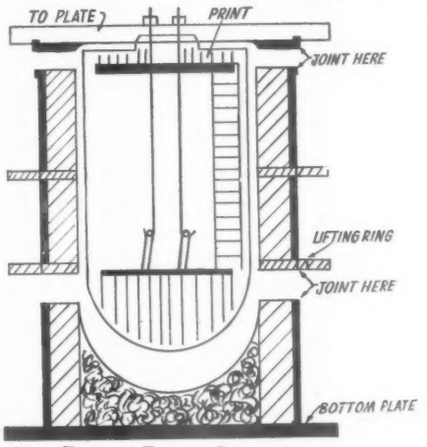


The outside of the mould, if not jointed, would take an appreciable time to dry; moreover, it appears a difficult job to black and finish nicely.

The accompanying drawings offer an alternative method, which has every appearance of being safer. To make the core, grid A is rammed up in the dummy, and is bricked up to grid B. A loam brick in every course is suggested, with the object of assisting contraction, or better still an easing bar might be built in.

The outside is bricked up in the ordinary way with a joint at the dome, which has the dual purpose of assisting both the drying and blacking operations. The top, it will be noted, is almost flat.

When closing the mould, the top is carefully lowered over the print in the top of the core, and two bolts are tightened up into the staples. The complete assembly is lifted and lowered into the outside. Whilst the beam and chains are still attached, the assembly is lifted at the dome joint and the wall thickness is examined, blobs of clay having previously been put on to the dome part. After casting, the two bolts in the top are loosened; the top taken off; grid B is broken, and the easing bar removed. Such a method has every appearance of being "safe."



ALTERNATIVE METHOD FOR MOULDING A DIESEL ENGINE SILENCER.

Inter-Works Competition in the Russian Industry

In the inter-works efficiency and performance contests held during the third quarter of 1940 between the various iron and steel works of the U.S.S.R., no works was considered to merit the award of the honorary title of "Best Iron and Steel Works in the Soviet Union." A "First" was awarded to the Stalin Ironworks at Kusnetsk, a "Second" to the Serp-i-Molot works at Moscow, and a "Third" to the Electrostal works near Moscow. The title of the "Best Ironworks in the Soviet Union" was bestowed on the Stalin Works, as it achieved the highest operating rate in the Union, viz., 86 per cent.; pig-iron output was 102.4 per cent. of plan and economies in operation included 30,800 tons of ore, 9,500 tons of limestone and 13,000 tons of coke, while working costs were reduced by 0.2 per cent. The Krivoi-Rog ironworks actually attained 96 per cent. of capacity over the quarter, but its other returns were not so satisfactory. The best blast furnace was No. 2 stack at the Stalin ironworks, of which output reached 116.1 per cent. of plan. Second place went to No. 3 stack at the Magnitogorsk section of the Stalin ironworks, where the coke consumption per ton of pig-iron was reduced to a very low figure. At the best open-hearth works, No. 1 of the Serp-i-Molot, the useful output of steel was 88.5 per cent. as against the plan figure of 88.3 per cent., production costs were cut 0.7 per cent., and total output was a shade over the planned figure. Useful steel output at the best electric steelworks was 88.6 per cent. No prizes were allocated to any of the rolling mills as none could be credited with conspicuous achievements. The report of the competition, given in "Tschornaja Metallurgia," calls attention to the weakness of the finishing works in the Russian iron and steel industry, for while all raw material supplies are assured the output of these works still does not come up to expectations.

Cupola Tapholes

By JAS. TIMBRELL

Safe tapping and stopping up at the cupola spout is an important part of foundry routine. Reliable spout operation is necessary from many points of view, easy tapping and stopping up, and pivots mainly on the shape and size of the taphole, also the material from which this item and the "botts" are made.

The system set out in this article was developed with a view to overcoming some of the "snags" experienced with "made-in-place" tapholes. Where adopted, if details are carefully noted and adhered to, the actual tapping and stopping up can be carried out with confidence by any intelligent foundry hand with little training.

The dimensions given are for a three to three and a half tons melt per hour, associated with 5-cwt. charges, 10-cwt. taps. A space, 5 in. square, is cut away from the cupola lining, in line with the gutter, and a little below the cupola bottom bed line. A block of sea-sand core 4½ in. square by 6 in. long, that is the length

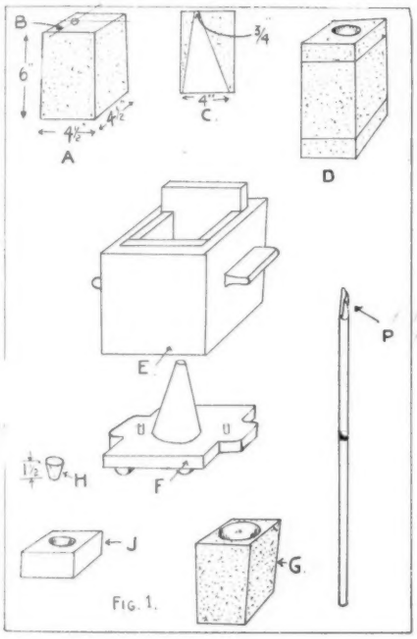


FIG. 1.

of the cupola brick lining shown at A, Fig. 1, is placed in the opening. A ramming clearance should be allowed round the sides and top. The bed line is marked off on this block, B. A ¼-in. hole is drilled through the bottom of the hole on the line. This ¾-in. hole is carefuliy filed out to a true conical shape, C, blacked up and dried. A cover core lid (with runner) and a bottom is stuck on and the mould cast in iron (D). An iron core box, framed with loose sides, is made to give a "core" to the sizes previously mentioned, shown E.

The cone casting is filed up smooth and fastened in its correct position on to the bottom plate F. This "core box" will produce a taphole brick as shown at G. For making these bricks a well-known proprietary brand was used. It is a good smooth plastic refractory and will dry out in the core stove without cracks if vented with a fine hatpin after ramming. The harder these bricks are rammed, the longer the life. With ordinary care one will last several "blows," although, with this method, it is almost as quick to replace with a new one in preference to chipping and patching up the old one with the same material.

A coremaker can produce these a dozen at a time, which in itself shows a saving of the cupola man's time. When these are thoroughly dry, they compare favourably with the refractory firebricks sometimes ordered to a special design. H represents a "clay bott" made from the iron core box J. This box is made from a 1½-in. length of core rammed in the small end of a tapping brick. Botts made from this box will be true to shape; two dozen or more are

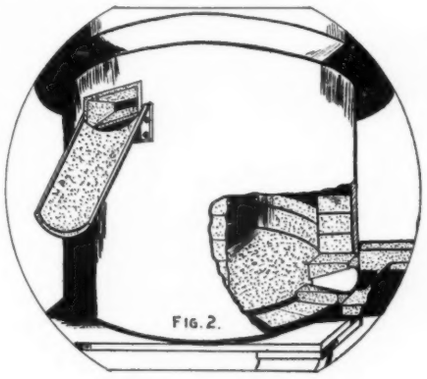


FIG. 2.

made (just before blowing time) and if kept handy under a damp bag will last the run.

Fig. 2 shows the taphole brick in place, and also the type of "slag-run-off" for easy opening and ramming up after draining. Fig. 3 is a sectional view through the centre of cupola bed. taphole and spout, and Fig. 4 shows the dimension from bed line to slag hole bottom.

Fig. 5 illustrates some of the snags in "made-in-place" tapholes, the clay "botts" are shown

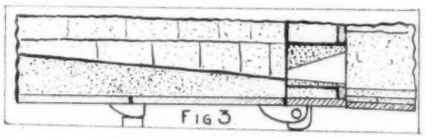


FIG. 3

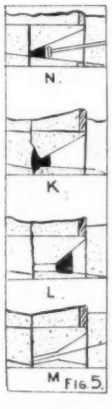


FIG. 5.

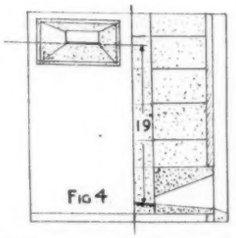


FIG 4

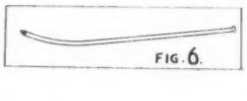


FIG. 6.

black, the shape of the hole by the outline. K shows a taphole which has spread inside the cupola during the making, long thin botts will spread under the metal pressure during the "poke out," the bott breaks at the neck, the other piece has to be "floated," probably to find its way during the next tap into the same place, when the well is drained.

L shows the "iron-hole" type, a short bott will seal the taper section, leaving a neck into which the metal will set. Then a sledge hammer and steel bar is necessary to knock this back, with possible consequential damage to the hole for the rest of the run.

N is the best type, the cone taper stopping at the edge of the well metal, that is it causes the bott to finish flush with the inside face. On tapping out, the stream will remain flat in the spout, no matter what the volume behind it may be.

M is the dangerous kind of tapping hole, as the upward line and dip in the cupola bed will probably project the stream under full pressure over the side of the spout.

The "bott stick" washer should be ⅛ in. in diameter smaller than the thick end of the clay bott.

A suitable mixture for the botts is as follows: 60 per cent. fire clay, 30 per cent. floor sand, and 10 per cent. fine coal dust, thoroughly mixed (in dry form) in a bucket and water added to make a plastic. It is an easily compressed material. If prior to actual botting it is dipped again in coal dust, contact with the stream will not cause "splutter."

These botts will dry out quickly and are very friable afterwards. The chisel bar, P, Fig. 1, with a cutting edge as shown, will "tap-circle" round a bott without damaging the taphole brick. Care should be taken only to use this bar for easing the bott, as the inside pressure will force out the remaining part. Contact with the metal will take away the cutting edge of the bar. The usual pointed pokers should be available for any actual contact with the metal.

Before the first tap, botts should not be used. A mixture of floor sand and coal dust, as dry as will take ramming, should be packed inside the hole with a wood stick. This may take a handful, but is worth the extra trouble. It will eventually come to the face of the taphole inside, and then the hole is rammed hard for about 2 in. The sand inside the taphole will prevent the initial metal from setting immediately in front of the outlet.

When sufficient metal has been collected to warrant tapping, the sand can be scratched away in the taphole with a pointed rod, until the red metal appears, a sharp push in and up into the well metal will release a good flow, taking the sand with it.

Fig. 6 shows a rod suitable for the purpose, as this type will not damage the cupola bed bottom immediately in front of the taphole.

Book Review

Electrical Engineer's Companion. Published by the Publicity Department of the London Electric Wire Company & Smiths, Limited, 19, Queen Anne's Gate, London, S.W.1. Price 3s. 6d.

Only about half this waistcoat pocket reference book is devoted to the tabulation of electrical data, the balance being of the general engineering utility type. The choice in both sections is, however, admirable. It is of the type which will suit the average technician who has occasion to use electrical machines and instruments. Whilst only about half an inch thick, the book, using as it does very thin paper, contains 360 pages. If fresh editions are to appear, as the nature of the publication fully warrants, an effort should be made to keep them to the size and thickness of this first one, as most pocket references tend to become too weighty and nullify their original purpose. The matter included is well up to date, and should serve a useful purpose in the field strictly defined by the "pocket book" class. It frequently happens that foundry executives have to superintend the carrying out of repairs to machinery, and on such occasions they will find this little book particularly valuable.

Conditions in the Dutch Iron and Steel Industry

THE Germanisation of the Dutch iron and steel industry has been proceeding with characteristic thoroughness during the last nine months. Recently Vereinigte Stahlwerke A.-G., the German steel trust, acquired a large batch of founders' and preference shares in the principal Dutch steelworks, Koninklijken Nederlandschen Hoogovens en Staalfabricken, N.V., Ijmuiden, hitherto owned by the Dutch State and the City of Amsterdam. This acquisition brings control of the Vereinigte to about 40 per cent. of the total share capital of 20,280,000 fl. of the Dutch company. It may be recalled that for the last 20 years the Dutch concern has held a large batch of shares, first in the Phœnix A.-G. für Berg und Hüttenbetrieb and then in the Vereinigte Stahlwerke itself after its fusion with the Phœnix; the Dutch holding of Stahlverein shares totalled 20,000,000 Rmk.

Ijmuiden Report, 1939-40

The industrial position of the Dutch concern is shown by the financial report for the year to March 31, a summary of which was recently received in this country. In that period the Staalfabrieken made a net profit of 1,059,115 fl., after 1,558,311 fl. to depreciation and 1,850,000 fl. to reserves, from which a dividend of 5 per cent. was paid on the ordinary shares, as against 3 per cent. in the previous financial year; 5½ per cent. was also paid on the preference shares and 4 per cent. on the priority shares. According to the report, the raw-materials position had already become difficult in the winter of 1939, while the invasion of Holland brought the works to a standstill, a pumping station for the blast-furnace cooling system being seriously damaged. After repairs, one blast furnace was again put in commission, and the coke ovens again supplied with coal from the Limburg collieries. Later the steel plant and the pipe foundry also restarted, but output was restricted owing to the shortage of raw materials.

In the year under review, pig-iron output was 276,279 tons, against 275,712 tons in the previous year; in 1939-40, two blast furnaces and two batteries of coke ovens were operating. Coke output was 295,549 tons, against 281,848 tons, and gas supplied to the local grid totalled 19 million cub. m., against 18 million in the previous year. Output of the pipe foundry, which operated fairly normally, was slightly higher than in 1938-39. New sections of the steel plant were opened during the year, this being the only department of the works to be working to capacity throughout 1940; its products are destined solely for the home market and are made only from domestic scrap and stahleisen. Further orders were placed during the year for a sheet mill and for the addition of a third furnace to the steelworks, and erection had already commenced by the autumn. A separate gas-producer plant has been installed for the steelworks to make them independent of the blast furnaces and coke ovens.

On the outbreak of war, pig-iron exports ceased under Government prohibition in order to conserve supplies for domestic requirements. Coupled with a diminution of ore stocks from November, 1939, onward, freights increased eightfold together with other items which considerably raised costs of production. To ensure ore supplies from Bilbao to Ijmuiden, the company acquired a steamer at the beginning of 1940, and several shipments were made during the year. Some difficulties were also experienced in regard to fuel supplies. Pig-iron sales exceeded the output, although exports declined from 223,000 tons to 159,200 tons, while domestic buying expanded from 72,800 tons to 119,700 tons. Imports of pig-iron were again around 17,000 tons. The bulk of the steel made was bought by Dutch re-rollers, a little also going to Belgium. Pipe sales were greater than in 1938-39. Iron and steel prices steadily advanced, but the increases were insufficient to offset the heavy increase in costs of production. To cut down the latter the works have been operating one shift instead of two as hitherto.

It should also be reported that, in view of the importance attached by the German authorities to the Ijmuiden steelworks, reflected in the acquisition of capital control and arrangements for supplies of raw materials, these works being apparently required as the nucleus for the maintenance of the iron and steel trade in Holland, the plant has frequently been made the objective of attack by our bombers, especially during recent months. According to Air Ministry *communiques*, considerable damage has been done to the plant and direct hits registered on the blast-furnace plant. It would appear, therefore, that activity at Ijmuiden has been impaired and that the current rate of output may be below normal.

German Sales Control

The German authorities have also extended their control of the Dutch iron and steel trade in directions other than the virtual taking over of the Ijmuiden works and expropriation of the previous shareholders. Since last October there has been close control over the distribution of raw materials to the iron and steel industry, a special branch having been formed in the Rijksbureau voor Ijzer en Staal which is now under the direct supervision of the German authorities controlling supplies. Some steps were also taken towards the formation of a central buying organisation to include all Dutch iron and steel merchants, as well as to supply materials direct to consumers, thus sidetracking the merchants. Supplies are apparently being provided under a quota system based, not on the past volume of business of a firm, but on the importance of the order in the light of changed trading conditions and current demand in the Netherlands. A special procedure has also been instituted for handling orders from German firms; where these exceed 100 kg., they must be submitted for approval to the Rijksbureau, to ensure that sufficient raw material is allocated for dealing with the order. Orders placed by German firms in Holland itself do not require approval, but will rank as items of domestic trade.

(*Continued from next column.*)

circuit breakers were also installed at this time as well as the necessary voltage selector panel and the then most modern type of electrode control. Due to the fact that the transformer primary winding would be materially shortened to obtain the highest secondary voltage, a 10 per cent. reactor was also found necessary and installed. This reactor was also tapped and the circuit so designed to connect sections of the reactor in and out as the transformer output voltage was changed. The electrode control panel was equipped with high-speed contactors and arranged to give three times the speed when raising the electrodes as when lowering them. The new contact-making ammeters contained untapped coils which were shunted with a rheostat having 50 steps and making possible a much greater variation in power input than with the original tapped coil type.

After the new equipment was installed, the two furnaces were operated with a proved added capacity of 25 per cent. in output.

New Mellon Research Fellowships

New research fellowships established last year by the Mellon Institute of Industrial Research, Pittsburgh, include one for foundry practice and one for powder metallurgy technology.

Modernising Electric Furnaces*

THE factors involved in reconditioning and modernising electric furnace equipment installed nearly 20 years ago are discussed by G. O. VAN ARTSDALEN in the course of a short Paper which he presented to the Assocation of Iron and Steel Engineers at Philadelphia. Some of the salient points are appended.

Improvements were added from time to time to the 6-ton furnace concerned as they were proved to be beneficial toward improving melting practice, speeding up production and reducing power disturbances.

The furnace in question was of the latest design in 1921, but its shortcomings were numerous. Its three electrodes were controlled by tapped contact-making ammeters which controlled the start, stop, and reversal of single-speed electrode motors through slow-acting intermediate relays. The coils of the contact-making ammeters contained eleven taps varied by a dial switch, and the power input to the furnace was varied in eleven definite steps which at times seemed to be a small fraction of the number actually needed. Two electrode motors themselves, having but one speed, lowered the electrodes as rapidly as they raised them, so that when melting heavy scrap of high conductivity, tremendous current surges were created and great difficulty was experienced in keeping the transformer oil circuit breaker closed during the melt-down period.

The 1,500 k.v.a. transformer supplying power to the furnace was of the single secondary voltage, low reactance type which in no way reduced the troubles caused by poor electrode control.

After operating for several years with the equipment the necessity was felt for increasing the melting capacity by purchasing new melting equipment or speeding up the production of the existing equipment to take care of the increased needs. A 3-ton furnace was also operated with controls of the same type as the 6-ton furnace, following the same general furnace practice.

After a careful study of the two methods proposed to step up production, the decision was made to modernise existing equipment.

The 3-ton furnace was originally supplied with power from a 750-k.v.a. transformer, which also created a limitation to melt down speed. This transformer was of the oil-insulated self-cooled type, and any attempt to shorten melting time reflected immediately on the transformer temperatures, which in spite of added air-blast and oil circulators persisted in remaining in the vicinity of 70 deg. C. most of the time.

The 1,500-k.v.a. water-cooled transformer originally installed for the 6-ton furnace was, with the new set-up, used to replace the 750-k.v.a. transformer then at the 3-ton furnace. This 3-ton furnace, due to its small size, could produce to expectations with but one secondary voltage and, with the addition of an external 10 per cent. reactance, a two-speed electrode motor control panel and a solenoid-operated oil circuit breaker, the 3-ton furnace was found to be able to produce approximately 20 per cent. more tonnage than before.

A 2,500-k.v.a. oil-insulated, water-cooled transformer was purchased for the 6-ton furnace, which was of a greatly increased reactance over the 1,500-k.v.a. transformer and had the additional possibility of being set up for three different voltages at a time to be selected at will from the control panel. Tap-changing oil

(*Continued in previous column.*)

* From "Iron and Steel Engineer."

Observations on Cast-Iron Enamelling*

By A. BIDDULPH

(*Continued from page* 302.)

Abrasive

The introduction of metallic abrasives some years ago, and the increased insurance premium required for sand-blast operatives due to the possibility of their contracting silicosis as an industrial disease, has led to an almost complete change from silica grit to chilled-iron grit in the cleaning of castings for enamelling. Despite the difficulties inherent in the change to a much heavier abrasive, and the undesirable "smudge" left on the surface of the casting, enamellers were quick to realise that with a good-quality metallic abrasive there was considerable increase in production as compared with flint or sand.

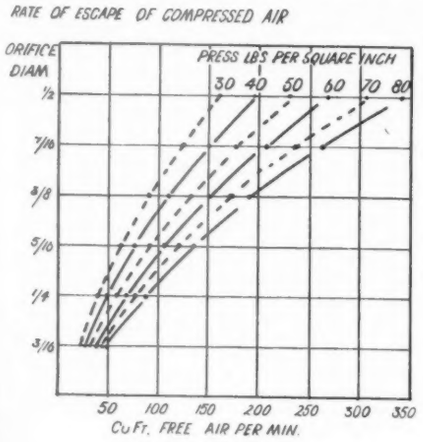


FIG. 12.

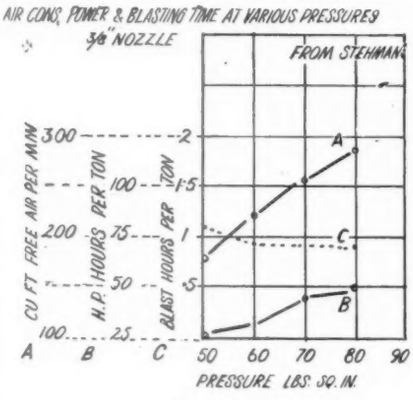


FIG. 13.

Suggestions have been made that the metallic abrasive wears so slowly that it tends to pick up graphite from the casting, and later to leave some of this graphite on the blasted surface; hence the "smudge." The investigation of Hurst and Todd, however, showed that the amount of graphite on the surface of grit in use is very little more than on new grit (0.16 against 0.10), though there is a somewhat higher proportion of graphite on the fine grit exhausted from the blast system. The smudge is more likely to consist of very fine particles of cast iron adhering loosely to the casting. It can easily be brushed off. A method of eliminating this smudge is to use a mixed abrasive of 95 per cent. metallic, 5 per cent. silica. The flint serves to remove the smudge, and in blasting by hand it also helps the operator to observe the impact of the blast stream upon the casting.

The size and shape of abrasive and the mixture of sizes are important. For smaller bore nozzles the finer grades of grit should be used, otherwise there is a possibility of clogging. It is difficult to give exact figures, as the different grit makers do not standardise on the size numbers. Permissible grit size will also depend on air pressure, as higher pressures give greater air velocity and can carry larger sizes of grit. These, having greater inertia, will be effective at a greater distance from the nozzle and will give a deeper cut, but they leave a rougher surface than finer grit.

In use, the grit is subject to change in two ways: either it is cracked on impact and breaks into smaller pieces, so increasing the number of cutting edges but having less inertia, or, if the grit be soft (comparatively) its corners are rounded and cutting efficiency is much impaired, but size and inertia are maintained. The latter grit will last much longer in the machine with much reduced efficiency, and will tend to give a peening effect to the surface of the casting, such as would be obtained by the use of round steel shot. The harder grit will last for less time as the cracking will make fines which will ultimately be exhausted by the suction system, and it will appear that the grit has a much shorter life. This is so, but its short life is a useful life, whereas the extended life of the softer grit is really of little advantage. It is bad practice to save pennies on steel grit and lose pounds on badly blasted castings.

Air Supply

Probably the most expensive material in the whole enamelling cycle is compressed air, yet it is often treated as though it were as free as fresh air. Blasting plants are usually designed for a given pressure, and to work above or below that pressure is considered to be either unsafe or uneconomical. Undoubtedly it would be unsafe to work at higher than the designed pressure, but by adjustment to nozzle size and shape it may be possible to get more economical yet efficient blasting at lower pressures, depending upon the relative costs of power, wages and plant depreciation. A number of illuminating diagrams are shown in Figs. 12 to 16. These are the work of Stehman in U.S.A., who has demonstrated the possibilities of increased production by using moderate pressures, instead of very high pressures. In one instance the h.p. hours per ton were halved by using air at 50 lbs. through a ⅜-in. nozzle, instead of 75 lbs. pressure through a ¼-in. nozzle.

Water and oil content of compressed air are most important factors in blasting, and lack of attention to these points may nullify the effects of much otherwise efficient blasting. Adequate after-coolers will remove much moisture from the air after compression, but there should be also a large reservoir with draw-off cocks at the lowest part, and these draw-off cocks should be in use continuously. It is not sufficient that they should be blown on the occasion of the daily maintenance inspection. If they are kept very slightly open at all times so that there is a gentle escape of air, more oil will be removed than with a daily blow at high pressure.

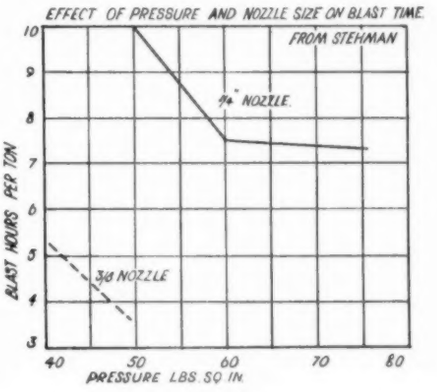


FIG. 14.

Nozzle

The old chilled-iron nozzles of parallel bore, which had a life of about an hour, is largely replaced by nozzles of carboloy or boron nitride whose life is measured in weeks. These alloy nozzles wear very slowly, and in shops where there are several blast machines a nozzle can be changed from one machine to another as its bore increases, in order to get the most effective use from it. The shape of blast nozzles varies, the relation of bore to length being within the range 1:1 to 1:10, a common shape in use to-day having an effective length about six times the bore.

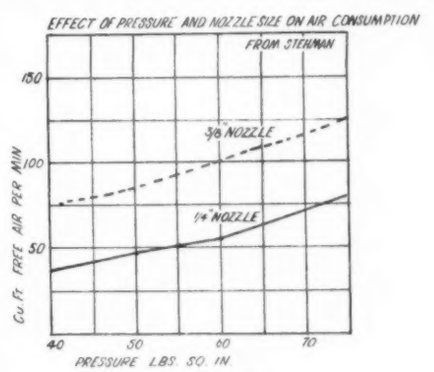


FIG. 15.

* Paper read before a joint meeting of the Falkirk Section of the Institute of British Foundrymen and the Scottish Section of the Institute of Vitreous Enamellers. Mr. Alex Cunningham presiding.

Fig. 17 shows a case where the bore was parallel when the nozzle was new, but which from use the outer end wore first until there was a taper of 3 in. from the parallel. Once this taper is established the wear continues evenly down the bore.

While the nozzle is new the blast stream leaving the nozzle continues as a narrow jet for a distance about the length of the nozzle or a little more, but will be longer or shorter according to the pressure. The higher the pressure the greater is the velocity of the air and abrasive, and the further the abrasive will travel before it loses velocity and spreads out. As the bore wears to the taper the blast stream will become wider but will start to spread at the same distance so long as pressure is main-

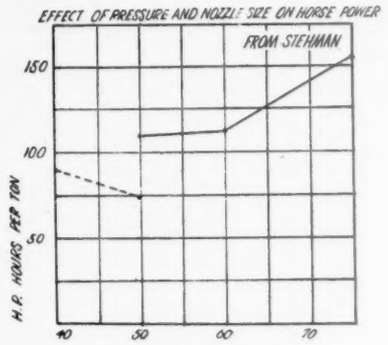


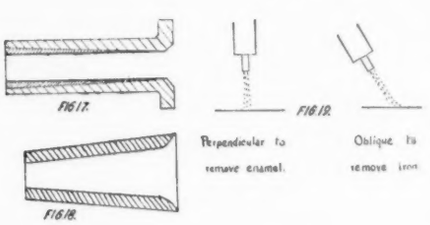
FIG. 16.

tained. With this type of nozzle there is some eddying of air due to the abrupt reduction in area of the air stream from the 1¼-in. dia. of the rubber nose to ⅜ in. in the nozzle.

With the nozzle shown in Fig. 18, an attempt has been made to minimise this eddying by having the inner end of the nozzle much wider than the outer end, and so getting a more gradual diminution of area. In use this nozzle tends to wear most at the outer end, though there is some wear throughout the whole length. When fully worn this nozzle tends toward the conditions holding for the parallel nozzle.

Nozzle Manipulation

The position of the nozzle in relation to the ware has considerable bearing upon the effec-



tiveness of the blasting. Maximum cut is achieved when the casting is in the position where the blast stream begins to spread. This distance from the nozzle will be governed by air pressure modified by the shape of the nozzle, and size of grit. In some tests recently made on a small machine with a ¼-in. parallel nozzle, and with air pressure 60 lbs., it was found that the distance for most effective cut was at 4 to 5 in., and that, if the nozzles were held at an angle of 60 to 70 deg. from the surface to be blasted, the cut was greater than when the nozzle was held perpendicular to the surface. Data relative to nozzle manipulation are given in Figs. 19 to 21. A repetition of this test on an enamelled surface gave rather different results, the cut being constant from 3 to 6 in., and being greater when the nozzle was perpendicular to the surface. This difference in results may be accounted for by the difference in the surface blasted.

With cast iron it is necessary for each bit of abrasive to cut a short groove in the surface of the iron, hence an oblique attack gives direction to the cut, whereas a perpendicular attack tends to drive the abrasive into the surface. Enamel being less tough than iron, it is only necessary for the abrasive to strike the surface hard to chip the enamel away, and this is more quickly achieved by perpendicular attack.

Conclusions

The suggestions made earlier regarding design may appear to be asking for more than can be achieved at a reasonable cost, and the replacement of a large number of patterns would seem to be an overwhelming task. It may be said, as has been heard elsewhere, that if a casting is good as a casting, then it should enamel satisfactorily. In other words, it is for the enameller to produce enamels that will work well on any casting.

In answer to that, all the faults mentioned give bad results on only a small part of each casting, representing up to 5 per cent. of the total surface, though often only 1 per cent. of the surface. The faults may be worse with one enamel than another, but as they are usually present, more or less, with any enamel, it is reasonable to suggest that it is the casting rather than the enamels that are inadequate. If the whole surface of a casting showed defects, then the enamel would be under suspicion, but if 95 per cent. is good and 5 per cent. bad, and the 5 per cent. is in the same part of several similar castings, then there is evidently a variation between the iron under the 5 per cent. bad surface, and the iron under the 95 per cent. good surface.

In laying the onus upon the enameller to produce better enamels for the castings, one point is often overlooked. During the past 20 years, great improvements have been made in enamels for cast iron as well as for sheet iron. Co-incidentally with this, there have been many improvements in the iron base, both sheet and cast, but it is likely that, from the point of view of the enameller, the maker of sheet iron has gone further to produce a consistently good iron stock, and to-day there is very little trouble indeed from sheet-iron enamelling stock, though considerable difficulties at times due to incorrect fabrication of parts.

Steel manufacturers have gone half-way to meet the enamellers, to their mutual advantage, and it is partly because the domestic appliance manufacturer can be sure of his stock, and count on only a very small number of rejects in the enamelling shop, that sheet iron is replacing cast iron in so many places.

Now that enamel is used to a greater and greater extent, as the only permanent finish to domestic appliances, it is suggested that, in order to retard any further displacement of cast iron for sheet iron, a close control by the foundry industry over these factors affecting the suitability of a casting for enamelling would not be without profit.

The author wishes to acknowledge with gratitude the help from earlier publications including:—E. Stehman, "Enamelist"; A. I. Andrews, "Enamels"; J. E. Hansen, "Manual of Porcelain Enamelling"; and J. E. Hurst and W. Todd, "Investigations into Sand Blast Abrasives."

DISCUSSION

On the conclusion of the lecture, the CHAIRMAN (Mr. Alex. Cunningham) expressed his appreciation of Mr. Biddulph's Paper.

MR. R. R. SHAW (Larbert), in extending his congratulations to the lecturer, stated that the remarks on design were very appropriate, as his personal opinion was that many of the enamelling faults in the Falkirk district could be attributed to faulty casting design. For example, the use of Yankee chaplets in lieu of heavy lugs and pins for door hinges was a definite improvement, and gave less blistering trouble. He (Mr. Shaw) would welcome the lecturer's opinion in respect to the merits and demerits of direct application of the enamel coating.

MR. BIDDULPH, in reply, said that direct application of the enamel was most desirable, both from the economic viewpoint and that of adherence, but a ground coat, either matt or glazed, had sometimes to be used to cover casting defects. About ten years ago a ground coat was essential, since enamels of that period were not of very good quality. Later developments in the enamel industry obviated this require-

NOZZLE MANIPULATION.

AVERAGE WEIGHT OF IRON REMOVED FROM C.I. PLATES.

Nozzle Distance in.	Perpr. Un-annealed Plates. Gm.	Perpr. Annealed Plates Gm.	Oblique Annealed Plates. Gm.
3	2.5	3.5	4.0
6	3.5	4.0	4.5
9	2.5	3.0	3.0

FIG. 20.

ment, but even to-day there was usually some part of the casting which did not turn out satisfactorily, so that, due to bad casting design, ground coats had still to be used. Again, the trouble known as "black specks," so annoying in highly finished work such as the enamelling of traders' scales, demanded the use of a ground coat.

MR. T. TYRIE (B.C.I.R.A., Falkirk) asked for Mr. Biddulph's idea of the requirements of the enamelling process, with respect to casting skin. He personally had observed, in a local jobbing enamelling shop, many and varied castings, with all qualities of skin, yet all requiring to be enamelled to a satisfactory finish. From his own observations, coupled with those of the jobbing enameller, he had found that castings made in foundries where sand control was rigid invariably gave the best results.

MR. BIDDULPH, referring to casting skin, said that smoothness or roughness was immaterial, provided that the casting itself was sound. He had seen many castings of beautiful surface quality which had been rejected during processing, because of, say, sponginess.

MR. WM. MONTGOMERIE (Leven) said that, of all Mr. Biddulph's enlightening remarks, he had

NOZZLE MANIPULATION.

AV. WT. IRON REMOVED FROM C.I. PLATES. Distance.	Perpr.	Oblique.
3 in.	4.5 gm.	5 gm.
6 in.	3.5 gm.	
ENAMEL REMOVED—60 SECONDS.		
3 in.	29 gm.	22 gm.
6 in.	29 gm.	

FIG. 21.

been particularly interested in the question of porosity due to varying section, especially in the experiment of closing the grain by the application of rock sand. In a recent investigation into the cause of blistering in the enamelling of laboratory stills, he had found that chilling was taking place due to metal composition, which prevailing circumstances would not allow of alteration. A small quantity of copper in the iron increased the enamellability of the casting, as well as its resistance to water pressure of 100 lbs. per sq. in. The copper appeared to close the graphite structure, and to give less surface oxidation, *i.e.*, the almost sub-microscopic copper inclusions caused the disappearance of surface chill, by controlling the degree of oxidation at the surface. Mr. Biddulph's

(*Continued on page* 374.)

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REGISTERED TRADE MARK

The Week's News in Brief

Trade Talk

MAJOR S. C. GUILLAN, editor of the Institute of Metals publications, who has been on military service since the outbreak of war, was recently promoted Lieutenant-Colonel.

THE NOMINAL CAPITAL of Smethwick Drop Forgings, Limited, has been increased by £150,000 to £325,000. The new capitalisation is in 5½ per cent. cumulative redeemable preference shares of £1 each.

TWO STEEL and one pig-iron plants are to be erected on the Pacific Coast, at a cost of $150,000,000, with a total capacity of 1,250,000 tons annually. Production is expected to start in from eight to twelve months.

THE TUNNEL PORTLAND CEMENT COMPANY, LIMITED, which already holds 274,471 of the issued 300,000 10s. ordinary shares of the Tunnel Asbestos Cement Company, Limited, is offering 20s. each for the balance of 25,529 shares.

THE COUNCIL of the Royal Society of Arts has decided to confer on President Roosevelt the Albert Gold Medal of the Society "in recognition of his pre-eminent services to humanity as a fearless and resolute champion of the ideals of national freedom and individual liberty."

THE BOARD OF TRADE have, with the approval of the Treasury, decided that, in respect of the period beginning June 3 and ending September 2, 1941, the rate of premium payable under any policy of insurance issued under the Commodity Insurance Scheme shall continue to be at the rate of 7s. 6d. per cent. per month.

CANADIAN PRODUCTION of steel ingots and direct steel castings in the March quarter totalled 554,482 tons, as against 464,165 tons and 251,074 tons in the parallel periods of 1940 and 1939 respectively. In the first quarter, 296,288 tons of pig-iron were produced, the corresponding quarter's totals being 283,507 tons in 1940 and 139,716 tons in 1939.

THE MAJORITY of the Clyde shipbuilding, engineering and allied firms have agreed to the formation of works committees as recommended by the Confederation of Engineering and Shipbuilding Trades for the settlement of shop disputes. The committees will be equally representative of the management and the employees and will have power to discuss and adjust all local grievances.

UNITED STATES automobile output since last September has been running at over 500,000 units per month. February production was 509,233 cars and trucks, with March production estimated at approximately 525,000. The total for the March quarter is about 1,558,000 units, the highest first-quarter output in the history of the industry. This is an increase of about 20 per cent. over the 1,302,108 units completed in the like 1937 period and overtops by a small margin the record of 1,546,319, established during the first quarter of 1929.

THE MINISTER OF HOME SECURITY appeals to all owners or occupiers of premises on which there are reserves of water of, say, 5,000 galls. capacity or over, which would be of service for fire fighting but have not been surveyed and noted by the fire brigades, to notify the Chief Officer of the local fire brigade at once. In spite of the surveys carried out by fire brigades throughout the country, both prior to and since the outbreak of war, there may still be premises with water storage facilities which have not been scheduled for fire service use.

THE GRANGESBERG concern, the big Swedish iron-ore enterprise, reports a net profit of 14,600,000 kr. for 1940, against 39,200,000 kr. for 1939. The company's activity has suffered heavily from the effects of the war, for after the occupation of Norway the company's westward exports were stopped, while shipments within the Baltic were hampered by shortage of suitable tonnage and the severe ice conditions. During the year the company lost nine vessels, totalling 68,000 tons, through actions of war. An unchanged dividend of 12 kr. per share has been recommended.

THE RUMANIAN iron and steel industry is now entirely controlled by Germany. Of the eight blast-furnaces available, four are in operation, two at the Reschitza works and two at the State Iron Works in Hunedoara. The German authorities have decided to modernise the iron-producing industry, whose chief difficulty appears to be the supply of iron ore, as the Rumanian mines produce only low-grade ore. To utilise these ores, Krupp rotary furnaces for the Renn beneficiating process are to be installed. It is proposed to erect four or five furnaces of a capacity of 30,000 tons each.

ANNUAL BLAST-FURNACE capacity of the United States steel industry increased nearly 2,000,000 tons during 1940, according to the American Iron and Steel Institute. No new blast furnaces were completed during the year, although several were under construction as the year ended and are scheduled for completion this year. As a result of these activities, by the end of the current year, blast-furnace capacity will be about 60,000,000 tons per year. At the end of 1940, the industry had capacity for producing 56,522,000 tons of coke pig-iron per year, 107,000 tons of charcoal pig-iron, and 981,000 tons of ferro-alloys. One year before, coke pig-iron capacity was 54,636,000 tons, charcoal pig-iron was 96,000 tons and ferro-alloy capacity was 992,000 tons. Those capacities for producing ferro-alloys do not include the ferro-alloy capacity of electric furnaces. Total capacity at the end of 1940 was about 5 per cent. greater than in 1918, and was very close to the 1929 blast-furnace capacity of 57,855,000 tons. Steelmaking capacity at the present time is almost 40 per cent. higher than in 1918, and 15 per cent. more than in 1929. Less pig-iron is now needed for steelmaking than in the earlier years, however, because of the greater use of scrap steel as a raw material.

Personal

THE DISTINGUISHED FLYING MEDAL has been awarded to Sergeant William Milne, R.A.F., who before joining up was with a Bonnybridge foundry.

MR. J. REID-YOUNG, director of Vickers, Limited, and associated companies, has joined the board of the Iron Trades Employers' Insurance Association, Limited.

MR. JOHN L. BROCKHOUSE, director of J. Brockhouse & Company, Limited, has been appointed chairman of West Bromwich and District Manufacturers' Association.

MR. F. S. WHALLEY, managing director of the Vulcan Foundry, Limited, and Major E. C. Straker, chairman of Robert Stephenson & Hawthorns, Limited, have joined the board of the North British Locomotive Company, Glasgow.

MR. G. COOMES has been appointed to succeed Mr. F. C. Studdert as secretary of the Royal Metal Trades Pension and Benevolent Society. Mr. Coomes has been acting secretary of the Society since Mr. Studdert met his death by enemy action last September.

MR. GUY LOCOCK, director of the Federation of British Industries, has returned to this country from abroad as a member of a Government mission. On Tuesday Mr. Locock was entertained to luncheon by Lord Dudley Gordon, the president, and past-presidents of the F.B.I.

MR. CHARLES EDGAR HOYT, who has been awarded the Joseph S. Seaman Gold Medal of the American Foundrymen's Association, is Executive Vice-President, Treasurer and Manager of Exhibits of the Association. Mr. Hoyt was born in Wayland, Michigan, and came from a family of foundrymen. During vacations he worked in the foundry and, on finishing school, was associated for a time with his father in operating a jobbing foundry and machine shop. He then accepted a position with the Michigan State College, at Lansing, in charge of pattern shop and foundry work, which position he held for three and a half years, resigning to accept a position on the engineering faculty of Lewis Institute, Chicago. On settling in Chicago, Mr. Hoyt took an active part in foundry association work. In 1907 and again in 1908 as Secretary-Treasurer of the Chicago Foundry Foremen's Association (later the Chicago Foundrymen's Club), he staged two day conventions and exhibits at Lewis Institute which attracted the attention of the national associations. This resulted in his being elected Secretary-Treasurer of the Associated Foundry Foremen of America at the A.F.A. Convention in Toronto in 1908 and, the following year, Secretary of the Foundry Supply Association. Mr. Hoyt continued as secretary and manager of the exhibits of this Association, and its successor the Foundry & Machine Exhibition Company, until 1916, when the exhibits were taken over by A.F.A. and he was made Manager of Exhibits. When the Association was incorporated in 1916, Mr. Hoyt was one of the signers of the application for a charter, was elected a director, and has served continuously since that time. When the Association established a War Service office in Washington in response to a Government request, Mr. Hoyt was placed in charge, resigning from the faculty of Lewis Institute, which position he had held during all these years of Association activities. At the 1918 convention he was elected secretary-treasurer of A.F.A., succeeding Mr. A. O. Backert, who resigned to accept the presidency. In 1926, Mr. Hoyt was made executive secretary, treasurer and manager of exhibits. Since 1936 he has been executive vice-president [managing director], continuing his work in managing the exhibits, which he has staged so successfully that he is recognised as the foremost manager of industrial exhibits in the United States.

Wills

AIRD, K., chairman and governing director of Glover & Main, Limited ...	£51,405
WOMERSLEY, HERBERT, of Sandal, Wakefield, engineer, of Williams & Womersley, Limited, Inge Foundry, Wakefield	£53,715

Obituary

MR. G. WESTLEY, secretary of Sidney Flavel & Company, Limited, Eagle Foundry, Leamington, since 1933, died on May 29.

MR. FRED MARSHALL, a partner in the firm of George Robson & Company, Eclipse Engineering Works, Sheffield, died last week.

MR. CHARLES WILLIAM WILLIAMSON, for 28 years a manager at the Parkbridge Ironworks of H. Lees & Sons, Limited, Ashton-under-Lyne, died recently.

MR. THOMAS GIFFORD ELLIOT died on Sunday, May 25, at the age of 68. Mr. Elliot, who was a Fellow of the Institute of Chemistry, had been on the research department of Hadfields, Limited, Sheffield, for nearly 40 years. He had been chief chemist for a long period.

New Companies

(From the Register compiled by Jordan & Sons, Limited, Company Registration Agents, 116 to 118 Chancery Lane, London, W.C.2.)

Curran Machine Tools, Limited—Capital, £10,000. Directors: J. and P. E. Curran, Mor-Hafren, West Drive, Porthcawl, Glam.

G. H. White & Company, Limited—Capital, £3,000. Heat-treatment specialists and engineers, etc. Director: G. H. White, 25, Fold Crescent, Sheffield.

Applications for Trade Marks

The following list of applications to register trade marks has been taken from the "Trade Marks Journal":—

"CASCADUO"—Drying plant. ERNEST NEWELL & COMPANY, LIMITED, Station Road, Misterton, Notts.

"PARAWASH"—Machines for cleaning metal. ALFALAVAL COMPANY, LIMITED, Great West Road, Brentford, Middx.

"INTASIL"—Metals and alloys. INTERNATIONAL ALLOYS, LIMITED, Buckingham Avenue, Trading Estate, Slough, Bucks.

"VACROM"—Cylinder liners. HEPWORTH & GRANDAGE, LIMITED, St. John's Works, East Bowling, Bradford, Yorks.

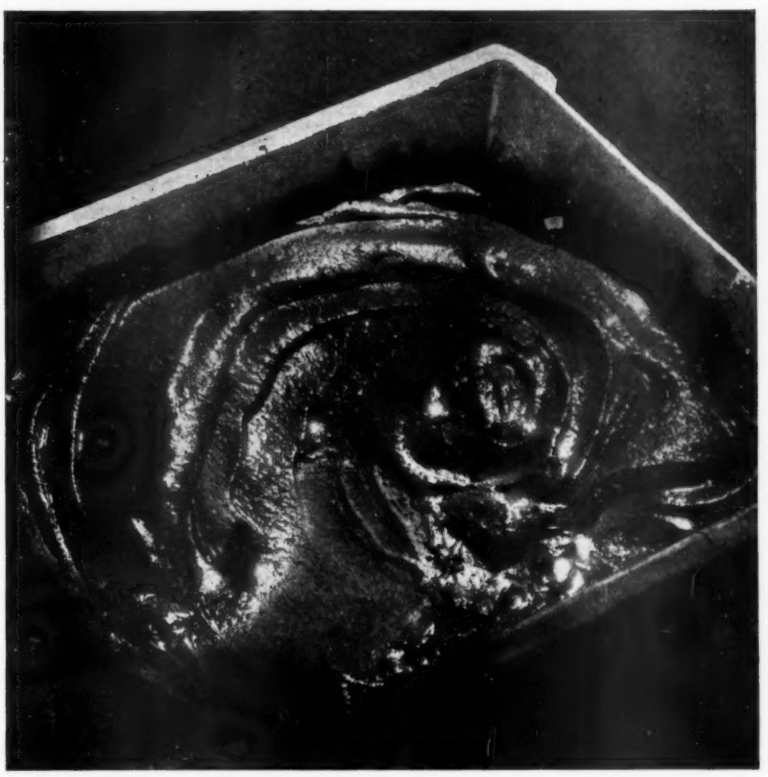
"MELPURE"—Magnesium and metallic alloys. MAGNESIUM ELEKTRON, LIMITED, Abbey House, Baker Street, London, N.W.1.

"ELEKTRON"—Transmission gears and gear boxes, conveyors, heat and steam accumulators, hand tools, etc. MAGNESIUM ELEKTRON, LIMITED, Abbey House, Baker Street, London, N.W.1.

Application to the Cutlers' Company, Sheffield

"ALCOMAX"—Magnetic metals and alloys. SWIFT, LEVICK & SONS, LIMITED, Leveson Street, Sheffield, 4.

Watch this Dictator of Firebrick Life



THERE are some users of refractory bricks who are curiously careless as to the cement they employ. Whilst insisting upon sound and suitable bricks they build them with an inferior cement. They let cement dictate the life and durability of refractory bricks. The shrewd refractory user knows that a dependable cement is worth its cost many times over. Experience shows that in structures jointed with ordinary fireclay, extensive erosion originates in the joints. Joints made with any of the following cements are as hard and mechanically strong as the firebricks.

DURAX No. 3 is a 42/44% alumina, air-setting, high temperature jointing cement suitable for bonding firebrick linings working under high duty conditions. A special feature of Durax No. 3 is its fine grading, which not only gives the cement good "workability" and makes it easy for the mason to use, but also permits a brick-to-brick joint which is so desirable in furnace construction. To obtain the maximum length of service from your firebrick linings, specify Durax No. 3 Refractory Cement for jointing.

PYROLYTE H.T. CEMENT (air setting) for jointing basic bricks in re-heating furnaces, and also for jointing and wash-coating firebricks where furnace conditions produce erosive slag.

DURAX No. 3 REFRACTORY CEMENT (air setting) for jointing and wash-coating all types of firebricks, working under normal and high duty conditions.

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BASIC BRICKS: *Spinella, Saxpyre, Supermag, Diazite, Dolomax.*
ACID-PROOF REFRACTORIES: *Obsidianite, Losol.*

INSULATION: *Amberlite* Bricks, Cement and Concrete. SILICA BRICKS: *Lowood, Meltham, Allen, Quartex.* CEMENTS: *Sintex, Durax, Pyrolyte.* PLASTICS: *Durax, Rotaline, Plastic K-N., Glendoline, Ground Ganister, Steel Moulders' Compositions.* SILLIMANITE: Tank Blocks, Bricks and Cements. SANDS: Moulding, Brick Facing, Silica, Glass.

Raw Material Markets

Hematite and low-phosphorus foundry irons are reserved for the use of works engaged on contracts placed by Government departments and other consumers catering for the needs of the war effort and are not, generally speaking, available to other users, so intense is the demand on priority account. But supplies of high-phosphorus iron and other grades not required solely for work of national importance are being delivered freely to buyers under licences granted by the Iron and Steel Control and light foundries, in particular, are receiving sufficient for their current needs; in fact, useful reserve stocks are being built up in many instances. Unfortunately, the part which the light-castings industry is able to play in the war effort remains very disappointing, while orders from other directions are quite insufficient to permit full-time operations to be recorded. Throughout the iron and steel industries the Whitsuntide holiday was restricted to a very short break. Since the beginning of the war repairs to plant have been undertaken with the minimum of lost time, so that extended holidays on this account are now avoided.

Pig-Iron

MIDDLESBROUGH—The current output of Cleveland foundry iron in no way satisfies, nor is it intended to satisfy, the needs of consumers, despite the comparatively low level of consumption. Blast furnaces in this district are using their resources to meet the pressing demands of the steelworks, for basic iron chiefly, and the manufacture of other irons usually produced in this area has had to be sacrificed. Large tonnages of foundry iron from the Midlands furnaces are being delivered here, so that users are in no way inconvenienced. The hematite supply position has been very tight for a long time past and cannot be expected to improve in the early future, as the quantity of hematite ores available is not adequate. Fortunately, the Control have quite substantial tonnages of imported hematite on hand, but only really urgent demands are catered for from this expensive reserve. Ingenuity is being shown by various users of hematite, who are, in many instances, obtaining satisfaction from the greater use of steel scrap, refined iron and high-phosphorus iron, and these materials are being incorporated quite extensively in consumers' mixtures.

LANCASHIRE—The Whitsun holiday was not allowed to interfere with industrial activities to the extent normally associated with the festival, and after a short break full operations were resumed at the works in this area. Heavy engineers and allied trades are operating to capacity on orders directly connected with the war effort, and are assured of a continuance of brisk activity over a long period. As yet, very few works in the light-castings and jobbing trades have any material volume of urgent business on hand, and outputs generally are much below peacetime levels. Builders' requirements of the products of light-castings makers remain on the small side, and there are no prospects of an early improvement in the situation, while export outlets also are appreciably curtailed by wartime conditions.

MIDLANDS—Activity among the heavy engineering trade continues to be very brisk; not only are works fully employed on current orders, but there is a steady flow of replacement contracts coming to hand from Government departments, so that no let-up may be anticipated in outputs while the need for production on a war basis exists. Some difficulty was experienced a while ago owing to supplies of low-phosphorus iron and hematite being on the short side; this remains the case, but makers are now much better situated because of the methods they have used to incorporate high-phosphorus iron in their mixtures. The latter grade of iron is made, of course, from ores raised in this country, whereas other better quality irons are manufactured from imported ores. Thus, the demand for high-phosphorus iron is considerably heavier than would have been the case if other grades were more freely available, as the chief peacetime call for high-phosphorus material emanates from the light-castings trade, which continues to be rather poorly placed for business. Their home trade has been drastically reduced by wartime restrictions, while export outlets are now very few.

SCOTLAND—There is little improvement to report in the flow of pig-iron deliveries to the heavy engineering works, and hand-to-mouth operations are still the rule. Consumers would be glad of the opportunity to lay in stocks of iron, but present conditions preclude the realisation of such a desire. Interruption of production is avoided at all works employed on urgent orders, so that the situation might be much worse than it is. Supplies of iron for the manufacture of light castings, on the other hand, are very satisfactory, but users are poorly situated for work, and consumption is at a comparatively low ebb. Steel-making irons are fully absorbed.

Coke

Good progress is being made in the drive to accumulate stocks of foundry coke at the consuming points, and it is expected that well before the winter arrives all the major users will possess sufficient to tide them over a lengthy period should deliveries become irregular through any cause. Although quite large tonnages are going into stock, current needs are heavy, so that ovens are kept busily employed in coping with orders. An increase of 1s. 3d. per ton in the prices of Durham and Welsh foundry coke has been announced by the Control authorities, and is due to the higher coal prices. The higher coke quotations are retrospective to June 1. For delivery to Birmingham and Black Country stations, the current price of Durham best foundry coke is now 62s. 9d. per ton.

Steel

The steel industry continues to be fully extended in meeting urgent Government requirements, and the volume of ordinary civil business in steel will inevitably remain at the present low level, as only in this way can war contracts be executed promptly. Makers are being pressed for almost all grades, but naturally the descriptions most in demand are those required by shipbuilders, marine and general engineering establishments, and other manufacturers operating exclusively on Government contracts. All responsibility for distribution of supplies is now that of the Iron and Steel Control, who scrutinise every application very carefully before making allotments.

Scrap

The Government has been able to announce that stocks of scrap iron and steel in various parts of the country are such as to give rise to considerable satisfaction. It is not denied that supplies of certain descriptions are on the short side, but the situation is undoubtedly improving, and supplies no longer fall really short of essential users' requirements. In fact, deliveries of some grades have been suspended at some steelworks, but of other sorts buyers are taking up all they can acquire. Foundries' needs are being well looked after in most instances.

Metals

COPPER—Very large tonnages of copper are passing into consumption, mainly on account of work of a vital character. Priority consumers are still getting all they require for carrying out Government orders, but other users are being rationed still further, in view of the Control's policy of safeguarding future supplies. Copper circles in the United States appear to be still apprehensive of the supply position there, owing to the absence of shipping space. American consumption is at peak levels in connection with orders for the defence programme and on account of British arms orders. If the shipping problems can be solved satisfactorily, the situation should not give rise to concern, as in addition to the record domestic output, American consumers have at their disposal vast tonnages from Latin-American mines, while considerable quantities of Congo and Canadian metal are being processed in the United States.

TIN—A small recovery was made in tin prices in London towards the end of last week, following the decline after the announcement that the Board of Trade had imposed a general curtailment of licences for the export of tin to the United States and other countries. Trading has been limited of late and there has been a considerable amount of hedging. Presumably consumers are awaiting more stable conditions before re-entering the market on a larger scale. Mr. Alex. B. Royce, Vice-President of Patino Mines, the Bolivian tin producers, recently stated that the entire output of the concern had been shipped to Britain without the loss of a single ton.

The Statistical Bulletin of the Tin Research Institute estimates world production of tin in April at 17,100 tons, compared with 21,900 tons in March. Production for the first four months was 73,800 tons in 1941, against 67,000 tons in 1940. United States deliveries totalled 13,955 tons in April, against 16,092 tons in March. U.S. deliveries in the first four months were 55,002 tons, compared with 33,479 tons in the corresponding period of 1940. Consumption of the United Kingdom was 2,691 tons in March last, against 2,155 tons in February, and 2,347 tons in March, 1940. World stocks of tin, including smelters' stocks and carry-over, decreased by 1,079 tons during April to 53,447 tons at the end of the month. Stocks at the end of April, 1940, were 40,680.

Tin prices on the London Metal Exchange during the past week have been as follow:—

Cash—Thursday, £261 15s. to £262; Friday, £263 to £263 10s.; Tuesday, £264 15s. to £265; Wednesday, £265 to £265 5s.

Three Months—Thursday, £263 17s. 6d. to £264; Friday, £264 15s. to £265; Tuesday, £265 to £265 5s.; Wednesday, £265 to £265 5s.

SPELTER—It is unlikely that very much spelter will be released for other than urgent purposes for a considerable time, as the supply position does not warrant general distribution of the metal at present. There is no actual shortage, but careful allocation alone can ensure a continuance of ample supplies for Government contracts. It is believed that the United States will supply Britain with about 46,000 tons of zinc during the current year, in addition to supplying Turkey, India, South America and China with appreciable quantities. American output of zinc expanded from 478,000 short tons in 1938 to 724,000 tons last year, a record, and output is expected to increase by 25 per cent. this year, while an output of about 1,000,000 tons is likely to be achieved in 1942.

LEAD—Adequate supplies of lead continue to be forthcoming to meet essential needs, and a fair quantity is available for distribution among other users, although some tightening up in deliveries is expected in the near future as a precautionary measure. This should not cause much inconvenience, as non-essential consumption, on the whole, is at a low ebb.

Patent Specifications Accepted

The following list of Patent Specifications accepted has been taken from the "Official Journal (Patents)." Printed copies of the full Specifications are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each. The numbers given are those under which the Specifications will be printed and abridged, and all subsequent proceedings will be taken.

532,052 INSHAW, G. R. Method of and apparatus for drawing metal tubes.

532,099 CUTANIT, LIMITED. Sintered hard metal alloys, in particular for tools and working appliances.

532,136 INTERNATIONAL DE LAVAUD MANUFACTURING CORPORATION, LIMITED. Centrifugal apparatus for casting metal pipes.

532,156 FERRO ENGINEERING COMPANY. Bottom rings for hot tops for ingot moulds.

532,170 BRITISH THOMSON-HOUSTON COMPANY, LIMITED. Methods of and means for removing defects in billets and the like.

532,174 SONDHEIMER, A., and LEHMANN, H. L. Method for the melting of hard metal alloys and carbides.

532,181 BIRMINGHAM ALUMINIUM CASTING (1903) COMPANY, LIMITED, and PRITCHARD, P. Metal casting.